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FTB 324,FTB 324AE

Dual Medium Intensity Obstruction Lighting System Reference Manual

PERSONNEL HAZARD WARNING

DANGEROUS VOLTAGES

Dangerous line voltages reside in certain locations in this equipment. Also, this equipment may generate dangerous voltages. Although FTCA has incorporated every practical safety precaution, exercise extreme caution at all times when you expose circuits and components, and when you operate, maintain, or service this equipment.

Avoid Touching Live Circuits

Avoid touching any component or any part of the circuitry while the equipment is operating. Do not change components or make adjustments inside the equipment with power on.

Dangerous Voltages Can Persist with Power Disconnected

Under certain conditions, dangerous voltages can be present because capacitors can retain charges even after the power has been disconnected.

Protect yourself — always turn off the input (primary) power and wait for one minute for storage capacitors to drain their charge. Then check between the red and blue wires on the flashhead terminal block with a voltmeter for any residual charge before touching any circuit element or component.

Do Not Depend on Interlocks

Never depend on interlocks alone to remove unsafe voltages. Always check circuits with a voltmeter. Under no circumstances remove or alter any safety interlock switch.

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Section 1 — FTB 324 Introduction and Operation

System

The ElectroFlash™ FTB 324 System is a dual (white/red) flashing, medium intensity, obstruction lighting system consisting of an FH 324 Flashhead, a PC 324 Power Converter, and a PEC 510 Photocell with cable.

The power converter provides discharge energy to the flashhead, and contains components and circuitry to control flashing. The power converter operates a white light at 40 flashes per minute during the day. At night, it switches to a red light at 20 flashes per minute, and turns on steadily-lit markers. The power converter is usually installed near ground level.

The FH 324 Flashhead is a dual (white/red) flashhead. Together, the lenses and base enclose the flashtubes and other interior components. Latches secure the lenses, which tilt open for internal access. Position the flashhead to comply with FAA regulations in Advisory Circular 70/7460-1K, Obstruction Lighting and Marking.

A flashhead cable interconnects the power converter and flashhead. When FTCA Part Number 6340, or equivalent cable, is used, the two may be separated by up to 600 feet (180 meters). Consult the factory when a greater separation is necessary.

The photocell is connected directly to the main panel of the power converter at TB1-1 and TB1-2 to control switching between day and night operation. It can be located up to 100 feet from the power converter. (Longer distances are possible with heavier wiring.)

Specifications

Electrical specifications are listed for a single power converter.

Physical:

PC 324: (H x W x Depth, Wgt.)
14.00 x 16.75 x 8.44 in., 51 lbs.
355.6 x 425.5 x 214.4 mm., 23 kg.

FH 324 Flashhead: (H x Diam, Wgt.)
37.25 x 18.25 in., 31 lbs.
946 x 463 mm., 16.4 kg.

PEC 510 Photocell: (H x W x Depth)
3.06 x 2.58 x 1.02 in.
77.7 x 65.5 x 2.59 mm.

Aerodynamic Wind Area:
- Flashhead 1.86 ft.2, .173 m.2
- Power Converter 1.63 ft.2, .15 m.2

Environmental:
- Complies with FAA specifications in AC 150/5345-43

Performance Characteristics:

Application: L-865 and L-864

Flash Intensity (nominal):
- Day (White) 20,000 ± 25% ECD
- Night (Red) 2,000 ± 25% ECD
- Default Night (White Backup) 2,000 ± 25% ECD
- Beam Spread: Horizontal: 360º Vertical: 5º

Flash Rate:
- Day (White) 40 flashes per minute
- Night (Red) 20 flashes per minute
- Default Night (White backup) 40 flashes per min.

Electrical: (Power Converter)
- AC Voltage sine-wave, 120 or 240V, 60 Hz
- Volt-Amperes 250 peak
- Watts:
- Day (White) 130W
- Night (Red) 145W
- Night (Default White) 55W
- Markers (Sidelights) (each) 116W

System Operation

PCB1 Timing and Trigger Board

PCB1 governs all automatic functions. Two different PCB1 boards are used in the PC 324 Power Converter. The 24740xx board is used in all except the "E" models. The 24747xx board is used in the "E" models. The "xx" in the board's part number refers to its dash number, which changes with the board's internal programming. The major difference between the two is their jumpers, internal control and programming. Additionally, PCB1 for EagleWin "E" systems connects to a telephone

line for remote monitoring by a computer suing "Eagle" monitoring software. The factory sets the jumpers and programs PCB1 before it leaves the factory.

Setting Up PCB1

Function Indicators

LED indicators on the PCB1 board signal alarms and internal functioning. Observe these LEDs to monitor equipment operations during checkout and troubleshooting. The essential features on PCB1 for troubleshooting are shown in Figure 1-2 and Figure 1-3.

PCB1 24740xx

PCB1 (24740xx) has the following features:

- LED indicators indicating function
- A neon lamp indicating trigger power
- Jumpers for external programming
- An RS-232 socket for internal programming

Refer to Table 1-1 for indicator and lamp functions, and Table 1-2 for jumper settings.

PCB1 24747xx ("Eagle" Board)

PCB1 (24747xx) has the following features:

- Twelve LED indicators indicating function
- One neon lamp indicating trigger power
- Two jumpers for external programming
- One RJ11 telephone line socket for remote EagleWin monitoring
- One RS-232 socket for internal programming

Refer to Table 1-3 for indicator and lamp functions, and Table 1-4 for jumper settings.

Table 1-1 PCB1 24740xx Neon or LED Function Indicators

Lamp Label	LED or Neon Lamp	Function
NITE ERR	I1	On for incorrect intensity for night operation.
DAY ERR	I7	On for incorrect intensity for day operation.
PEC ALM	I2	*Photocell alarm*; Power converter failed to switch the day/night mode to the opposite state within a 19-hour period, perhaps due to its input.
WHT ALM	I8	*White alarm;* on when a white alarm occurs.
RED ALM	I3	*Red alarm*; on when a red alarm occurs.
MKR ALM	I9	*Marker alarm;* on when marker alarm occurs (a marker or markers are out).
FAN	I4	Not used.
SYNC	I 10	Flashes when flash control output is on. Flashes regularly during normal flashing operation of the power converter.
CONF	I5	*Confirm*; Flashes after each valid flash.
DAY	I 11	The circuit board is in day mode.
NITE	I6	The circuit board is in night mode.
MKRS	I 12	PCB1 is commanding markers to be on.
NEON	I 13	*Trigger power neon*; 120VDC trigger power is being supplied to the circuit board.

Table 1-2 PCB1 24740xx Jumper and Switch Settings

<table>
<tr><th>Jumper or Switch Label</th><th>Jumper or Switch †</th><th>Description</th></tr>
<tr><td>INT RED</td><td>JP1</td><td>Uncut (all models).</td></tr>
<tr><td>RES PEC</td><td>JP2</td><td>Cut in all models to allow usage of a resistive photocell.</td></tr>
<tr><td>ALRMON2</td><td>JP3</td><td>Uncut.</td></tr>
<tr><td>NOBACK</td><td>JP4</td><td>Cut to disable white light backup for failure of the red flashhead. Installation dependent.</td></tr>
<tr><td>FAILCLOSE</td><td>JP5</td><td>Uncut.</td></tr>
<tr><td>MRK0</td><td>SW1-1</td><td>Selects the marker lamp fail threshold. Chart etched on 24740 board shows “ALARM AT” thresholds.
MARKER Parameter in Board Software = 4ORLESS
<table>
<tr><th>Bulbs Installed</th><th>SW1-2/MRK1</th><th>SW1-1/MRK0</th><th>Alarm At</th></tr>
<tr><td>0</td><td>OFF</td><td>OFF</td><td>No alarms</td></tr>
<tr><td>2</td><td>OFF</td><td>ON</td><td>One bulb lit</td></tr>
<tr><td>3</td><td>ON</td><td>OFF</td><td>Two bulbs lit</td></tr>
<tr><td>4</td><td>ON</td><td>ON</td><td>Three bulbs lit</td></tr>
</table>
MARKER Parameter in Board Software = 5ORMORE
<table>
<tr><th>Bulbs Installed</th><th>SW1-2/MRK1</th><th>SW1-1/MRK0</th><th>Alarm At</th></tr>
<tr><td>0</td><td>OFF</td><td>OFF</td><td>No alarms</td></tr>
<tr><td>5</td><td>OFF</td><td>ON</td><td>Four bulbs lit</td></tr>
<tr><td>6</td><td>ON</td><td>OFF</td><td>Five bulbs lit</td></tr>
<tr><td>8</td><td>ON</td><td>ON</td><td>Six bulbs lit</td></tr>
</table></td></tr>
<tr><td>MRK1</td><td>SW1-2</td><td>Selects the marker lamp fail threshold. See the chart FOR SW1-1 above in this table.</td></tr>
<tr><td>CT</td><td>JP8</td><td>Cut to indicate top tier operation for this power converter in a catenary system. If both JP8 and JP9 are cut or both uncut, operation is for the bottom tier.</td></tr>
<tr><td>CM</td><td>JP9</td><td>Cut to indicate middle tier operation for this power converter in a catenary system. If both JP8 and JP9 are cut or both uncut, operation is for the bottom tier.</td></tr>
<tr><td>ISOL</td><td>JP10</td><td>Cut to allow an alarm for only local alarm conditions on this power converter.
Uncut to allow an alarm for local alarms and alarms signalled though a communications device.</td></tr>
<tr><td>RETROFIT</td><td>JP11</td><td>Cut to allow the 24740xx Circuit Board to emulate other boards on a tower of mixed circuit boards.</td></tr>
<tr><td>MARK-ERNO</td><td>JP12</td><td>Uncut — energizes the marker relay in day mode and de-energizes it in night mode.
Cut — de-energizes the marker relay in day mode and energizes it in night mode.
An energized marker relay turns off markers.</td></tr>
<tr><td>REDSENSE</td><td>JP13</td><td>Cut to enable the usage of sense boards. Uncut to allow usage with laminated transformers (#8111). For internal design changes. Factory use only.</td></tr>
<tr><td>-</td><td>JP14</td><td>Uncut; factory use only.</td></tr>
<tr><td>-</td><td>JP15</td><td>Uncut; factory use only.</td></tr>
</table>

† (Jumpers — OFF=CUT=OPEN)

Table 1-3 PCB1 24747xx Neon or Lamp Function Indicators

Lamp Label	LED or Neon Lamp	Function
NITE ERR	I 15	On for incorrect intensity for night operation.
DAY ERR	I 9	On for incorrect intensity for day operation.
PEC ALM	I 14	*Photocell alarm*; Power converter failed to switch the day/night mode to the opposite state within a 19-hour period, perhaps due to its input.
WHT ALM	I 8	On when a white alarm occurs.
RED ALM	I 13	On when a red alarm occurs.
MKR ALM	I 7	On when marker alarm occurs (a marker or markers are out).
FAN	I 12	Not used.
SYNC	I 6	Flashes when flash control output is on. Flashes regularly during normal flashing operation of the power converter.
CONF	I 11	Confirm; flashes after each valid flash.
DAY	I 5	The circuit board is in day mode.
NITE	I 10	The circuit board is in night mode.
MKRS	I 4	PCB1 is commanding markers to be on.
NEON	I 3	Trigger power neon; 120VDC trigger power is being supplied to the circuit board.
TD	I 1	Modem is in transmit mode.
RD	I 2	Modem is in receive mode.

Table 1-4 PCB1 24747xx Jumper Settings

Jumper Label	Jumper—Board Name	Description
INT RED	JP2	Not cut (all models).
RES PEC	JP1	Cut to allow PCB1 to recognize a resistive photocell connection.
TEST, LTV, DAY, NITE, RED	TP1 to TP5	Test points for factory use only.

Photocell

In a single unit installation, you connect the photocell to TB1-1 and TB1-2 on the main panel of the PC 324. In a triple-unit installation you connect it to TB1-1 and TB1-2 of the first power converter, the master unit. Other units are slaves. In triple-unit installations, the first PC 324 is the one that operates the top flashhead. In triple-unit installations, TB1-1 and TB1-2 of slave 1 are jumpered together, as is TB1-1 and TB1-2 of slave 2.

Power Converter Main Panel: Alarms and Signals

Terminals on TB1 of the PC 324 indicate various system failures and day or night modes of operation, and they are connected to electrically isolated contacts of relays inside the PC 324. Electrically isolated contacts are not connected to any other circuitry. They act as switches rated at 1 ampere 120 VAC, allowing you to connect the PC 324 to external monitoring equipment. They change state (for example, from normally closed (NC) to open or from normally open (NO) to closed) when the condition indicated on the front panel occurs.

Table 1-5 describes the available alarm functions on TB1 of the power converter.

Master/Slave Interconnect

The master/slave interconnect terminals at TB1-4 and TB1-5 are connected between power converters in a triple-unit installation. These terminal connections supply two functions:

- A synchronization signal to flash the lights simultaneously.
- A failure of a top light in night mode causes the master power converter wired to that failing light to signal backup mode to all power converters; all flashheads on the structure flash in backup mode (correct night intensity white back-up). Marker lights are turned off.

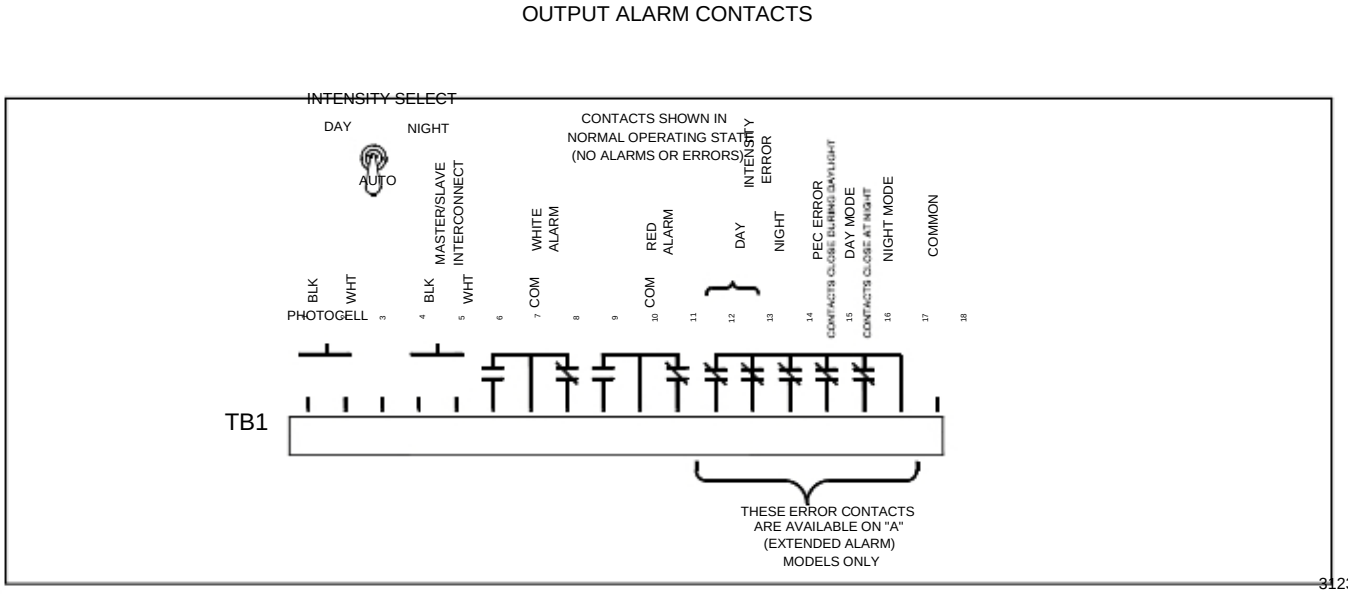
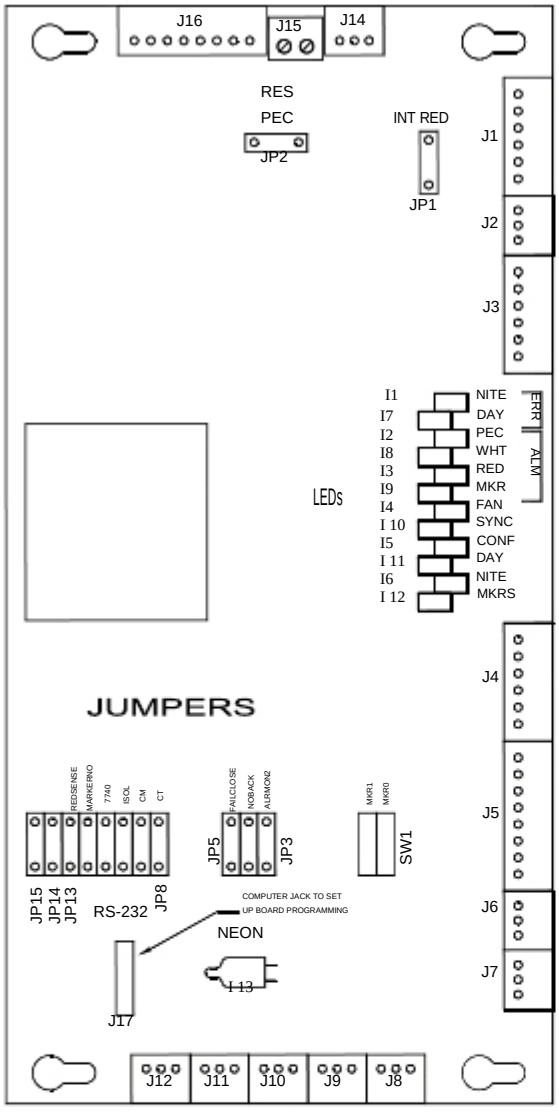


Figure 1-1 View of TB1 Wiring Functions for PC 324

Table 1-5 Alarm Functions

Alarm/ System	Function
White Alarm/all	Connections between TB1-7, and TB1-6 or TB1-8 signal the alarm for improper flash intensity or no flash at all. The normally open (NO) contacts close and the normally closed (NC) contacts open.
Red Alarm/all	Connections between TB1-10, and TB1-9 or TB1-11 signal the alarm when the PC 324 detected improper flash intensity or no flash at all during red night mode operation. The normally open (NO) contacts close and the normally closed (NC) contacts open.
Marker Alarm/all	Connections between TB5-5, and TB5-4 or TB5-6 signal the alarm under the following conditions: · One or more marker lamps is not functioning. · The marker lamp current is too low or not present. The normally open (NO) contacts close and the normally closed (NC) contacts open.
Intensity Error/ "A" Option	Signals a day intensity error between TB1-12 and TB1-17 or a night intensity error between TB1-13 and TB1-17. Error occurs if a flashhead is flashing at the incorrect intensity for the day or night lighting condition determined by the photocell. The normally closed (NC) contacts open.
PEC Error/ "A" Option	Signals a photocell error between TB1-14 and TB1-17. The error occurs when the PC has failed to switch from night to day as a result of reading the photocell circuit within a 19-hour period. This period is factory adjustable. The normally closed (NC) contacts open.
Day Mode/ "A" Option	Signals day mode operation between TB1-15 and TB1-17 when the internal operation of the power converter is in day mode. When the signal occurs as it should during daylight, the normally closed (NC) contacts are closed. These contacts open at night.
Night Mode/ "A" Option	Signals night mode operation between TB1-16 and TB1-17 when the internal operation of the power converter is in night mode. When the signal occurs as it should during nighttime, the normally closed (NC) contacts are closed. These contacts open during daylight.



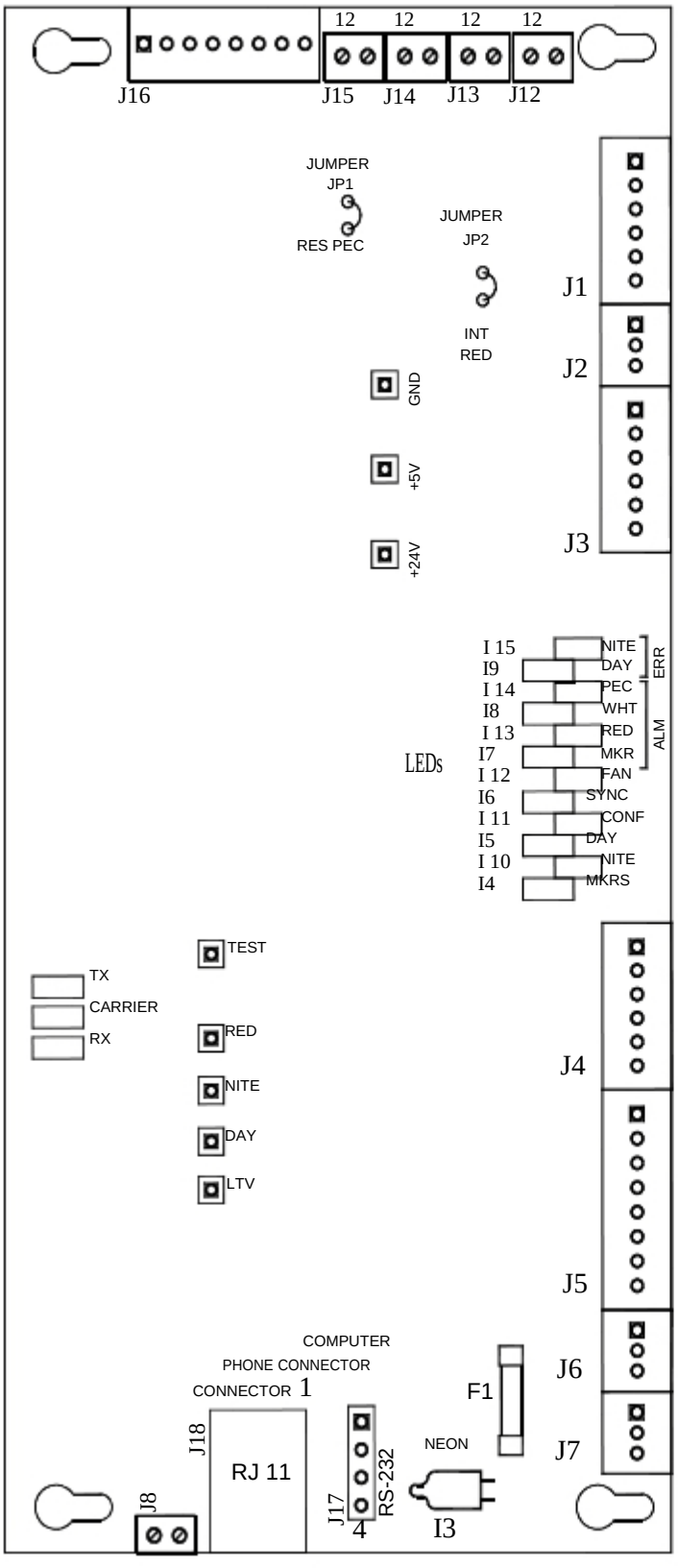
JUMPER †	FUNCTION
JP1	INT RED -- Not cut in the PC 324. This jumper is for power converters with internal controllers for external red beacon lamps.
JP2	RES PEC -- Cut to allow the power converter to use a resistive photocell. Cut in the PC 324.
JP3	ALRMON2 -- Applies to beacon lamps. Not used in the PC 324.
JP4	NOBACK -- Cut to disable white light backup upon the failure of the red night flashhead operation.
JP5	FAILCLOSE -- Applies to power converters that use external red light controllers. Not cut in the PC 324.
SW1-1	Selects the marker lamp fail threshold. Chart etched on 24740 board shows "ALARM AT" thresholds. MARKER Parameter in Board Softwere = 4ORLESS Bulbs Installed / SW1-2/MRK1 / SW1-1/MRK0 / Alarm At: 0 / Off / Off / No alarms 2 / Off / On / One bulb lit 3 / On / Off / Two bulbs lit 4 / On / On / Three bulbs lit MARKER Parameter in Board Software = 5ORMORE Bulbs Installed / SW1-2/MRK1 / SW1-1/MRK0 / Alarm At: 0 / Off / Off / No alarms 5 / Off / On / Four bulbs lit 6 / On / Off / Five bulbs lit 7 / On / On / Six bulbs lit
SW1-2	MRK1 - Selects the marker lamp fail threshold. See the chart above for SW1-1 (MRK0).
JP8	CT -- Cut to indicate top tier operation for this power converter in a catenary system. If both JP8 and JP9 are cut or both uncut, operation is for the bottom tier. Internal programming must be set to CATENARY or RED CAT for this jumper to be operative.
JP9	CM -- Cut to indicate middle tier operation for this power converter in a catenary system. If both JP8 and JP9 are cut or both uncut, operation is for the bottom tier. Internal programming must be set to CATENARY or RED CAT for this jumper to be operative.
JP10	ISOL -- Cut to allow an alarm for only local alarm conditions on this power converter. Not cut to allow an alarm for local alarms and alarms signaled to this power converter through a communications bus wire.
JP11	RETROFIT -- Cut to allow the 4740 board to emulate other boards on a tower of mixed circuit boards. The parameter RETROFIT TYPE in internal programming on the 4740 must also be set to the board type that the 4740 is to emulate: 7413, 7740-CMOS, or 7740-PLD.
JP12	MARKERNO -- Uncut to energize the power converter marker relay during the day and de-energize it at night. Cut to de-energize the power converter marker relay in day mode and energize it at night.
JP13	REDSENSE -- Cut to enable the 4740 board to be used with sense boards. Uncut to allow use with laminated transformers (#8111). This refers to internal design changes. Factory use only.
JP14	**Unused --** Factory use only.
JP15	**Unused --** Factory use only.

† JUMPERS -- OFF=CUT=OPEN

LED Indicator	Function
I1	NITE ERR -- On for a night intensity error.
I7	DAY ERR -- On when a day intensity error occurred (the light flashed at an incorrect intensity).
I2	PEC ALM -- On for photocell alarm (photocell failed to switch state within 19 hours).
I8	WHT ALM -- On when a white alarm occurs (white light failed).
I3	RED ALM -- On for a red alarm (a red light failure occurred).
I9	MRK ALM -- On when a marker alarm occurs (a marker or markers are out).
I4	FAN -- Not used.
I 10	SYNC -- Flashes when flash control is present on the master/slave interconnect line.
I5	CONF -- (Confirm) Flashes after the timing and trigger board detects a valid flash.
I 11	DAY -- On when the power converter is in day mode.
I6	NITE -- On when the power converter is in night mode.
I 12	MKRS -- On when PCB1 is commanding markers to be on.
I 13	TRIGGER POWER NEON -- On when the 120VDC trigger power circuit for the flashhead is active.

4740

Figure 1-2 PCB1 Pictorial (24740xx)



CONNECTOR	FUNCTION
RS-232	Computer cable connector used to program the circuit board at the factory.
RJ11	Telephone line connector.

JUMPER	FUNCTION
JP1	Cut to use the power converter with a resistive photocell. Cut on the PC 324.
JP2	INT RED -- Cut to use the internal red controller of the power converter. Not cut in the PC 324.

LED/LAMP	FUNCTION
I 15	NITE ERR -- On for night intensity error.
I9	DAY ERR -- On for day intensity error.
I 14	PEC ALM -- On for PEC alarm.
I8	WHT ALM -- On for white alarm.
I 13	RED ALM -- On for red alarm.
I7	MKR ALM -- On for marker alarm.
I 12	FAN -- Not used.
I6	SYNC -- Flashes when flash control output is on.
I 11	CONF -- (Confirm) Flashes after the PCB1 board detects a valid flash.
I5	DAY -- On when in day mode.
I 10	NITE -- On when in night mode.
I4	MKRS -- On when the board is commanding markers to be on.
I3	NEON -- On when 120VDC from the power transformer is applied to PCB1.
I2	RD -- Modem is receiving a signal.
I1	TD -- Modem is transmitting a signal.

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Figure 1-3 PCB1 Pictorial (24747xx)

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Section 2 — Outline, Mounting, Installation

Unpacking

Inspect shipping cartons for signs of damage before opening them. Check package contents against the packing list and inspect each item for visible damage. Damage claims should be reported promptly to the freight handler.

Tools

Although no special tools are necessary, FTCA suggests the following tools for installation and maintenance:

- #2, flat-blade screwdriver
- 5/16 inch, flat blade screwdriver
- #2, Phillips® 9-inch shank screwdriver
- Set of combination wrenches
- Medium, slip joint pliers
- Long-nose pliers
- 8- or 10-inch adjustable wrench
- Triplett ™ Model 630-NA VOM, or equivalent, analog volt-ohm meter
- Multi-purpose crimp tool

Access

WARNING

STOP: Before proceeding—read warning on Page iii. Disconnect the primary power before opening the power converter enclosure or flashhead.

Power Converter

Quick-release latches secure the cover. When you release these you can open the cover for internal access.

Flashhead

The flashhead normally contains no interlock. Do not open the flashhead unless you have disconnected primary power from the power converter. Wait one minute for storage capacitors to drain down. Open the flashhead and use a voltmeter to check that no voltage potential exists between the red and the blue wires. Look for these wires on the ceramic terminal posts.

You may pivot the lens open by disengaging quick-release latches. Be careful when opening the lens to ensure that it does not strike adjacent objects. Two lanyard cables secure the lens to the flashhead.

Mountings

Power Converter

Mounting and outline dimensions for the power converters are shown in Figure 2-1. Use the following guidelines for mounting the power converter:

- Ensure that adequate space exists around the equipment for access during installation, maintenance and servicing.
- Allow space for air flow around the power converter.
- You must use a bonding strap on a bolt through the power converter case leg. Connect the strap to the site grounding system.

FTCA does not furnish mounting hardware unless you order it as part of an installation kit.

Flashhead

Mounting and outline dimensions for the flashhead are shown in Figure 2-2. Protect the flashhead from lightning strikes. The flashhead may be mounted to painted or unpainted surfaces. Use the following guidelines:

- Use a lightning rod extended above the flashhead to protect it when it is mounted at the uppermost part of the structure.

- Avoid locating a lightning rod where it would prevent tilting the lens open or interfere with access by maintenance or service personnel.
- Use a bonding strap when mounting the flashhead to the structure, and fasten the bonding strap to the flashhead with the mounting bolt that goes through the leg that contains the ground connection.

Leveling

The flashhead must be level for correct vertical beam alignment. Two leveling vials are permanently attached to the flashhead assembly. When the flashhead is level, bubbles in both leveling vials are centered. For leveling, use the following guidelines:

- If adjustment is necessary, raise the appropriate mounting foot with shims or washers. Raising one foot by 1/16 inch (1.6 mm) tilts the beam about 1/2 degree.
- Take extreme care to ensure that all four feet rest snugly against a firm mounting surface before tightening the mounting bolts. Failure to do so could result in serious damage to the base when you tighten the bolts.

Photocell

Mounting and outline dimensions for the photocell are shown in Figure 2-3. Use the following guidelines:

- Locate the photocell where it has an unobstructed view of the polar sky.
- It must not view direct or reflected artificial light.
- The photocell may be supported directly by electrical conduit.
- Mount the photocell vertically on the top end of a vertical length of conduit to prevent water from entering and damaging the unit.

Red Light Fixtures

Obtain outline, clearance and mounting details for L-810 markers from separate drawings provided by FTCA (or others). This manual does not contain information about installing red markers.

Installation Wiring

NOTE

Only general information for a typical installation is presented here, and more specific information may be needed for your site. In particular, because the L-810 marker (side-light) lighting components for red nighttime lighting are often purchased from others, and have many variations, only general hook-up information for flashing and monitoring the red lights is included.

This manual may not contain all the information about installation wiring required for your site. *Consult any installation drawings prepared especially for your site or supplied with the equipment. Site installation drawings should take precedence*.

Also note that FTCA wiring diagrams define minimum requirements recommended for satisfactory equipment operation. These minimum requirements may not be enough, by themselves, to comply with local electrical codes. It is the responsibility of the installer to comply with all applicable electrical codes.

Consider the following wiring: power service, marker lights, power converter, master/slave interconnect, and the flashhead.

All installation wiring should have an insulation rating of 600 volts or higher.

You can find conduit and other distribution wiring details on electrical installation diagrams provided by FTCA or others.

FAA Advisory Circular 70/7460-1K gives the lighting requirements for various types of structures.

Power Converter Wiring

Power Service Wiring

Power service wiring must be sized to satisfy the load demand of the red light markers and the power converters. Each marker lamp draws 116 watts. Night operation of each power converter

requires 250 volt-amperes. See Specifications in Section 1.

A typical installation has three power converters and two tiers of markers. Thus, the last slave power converter connected together in a chain of units is connected to a flashhead only—no markers are connected to this unit. Each steady-burning marker draws approximately 1 ampere. To determine wire gauge, consider the total ampere load and the length of the run. Please read the notes on the installation wiring diagrams supplied both in this manual and with the equipment.

Please note that FTCA recommends the following guidelines for red light wiring:

- Using a maximum wire size of #12 AWG from the red light module terminal block inside the power converter
- Running a short length of #12 AWG wire to a junction box near the power converter when load requirements call for heavier gauge wire to red light fixtures.

Flashhead Wiring

The wiring between the power converter and flashhead requires five conductors with 600 volts (minimum) insulation. Two of the conductors must be #10 AWG. The other three may be #16 AWG (minimum; for mechanical strength) if you are cabling together individual wires. FTCA recommends using FTCA Part Number 6340 cable for this application.

To ensure reliable operation, FTCA recommends continuous wiring between the power converters and their associated flashheads without intervening junctions or splices.

If you use FTCA Part Number 6340 cable without electrical conduit, you should secure it to the main structure not more than 5 feet (1.5 meters) below the flashhead and at 5-foot (minimum) intervals between the flashhead and power converter.

Securing the Cable

Use the following method for securing the flashhead cable to a skeletal structure:

1. Run the cable along one of the tower legs and wrap one full turn of two-inch Scotchrap™ #50 tape, or the equivalent, around the cable and tower leg at 5-foot (minimum) intervals (1.5 meters). Space the cable one inch away from direct contact with a leg flange or and edge.
2. Wrap three full turns of one-inch Scotchrap Filament #890 tape, or the equivalent, over the Scotchrap #50 tape.
3. Wrap four full turns of two-inch Scotchrap #50 tape, or the equivalent, over the Scotchrap Filament #890 tape.
4. Perform steps 1 through 3 also directly above and below any tower leg flanges that the cable may cross.

Photocell Wiring

For triple-unit lighting, each individual lighting unit requires a power converter and flashhead, but the photocell is connected to only one unit in a triple-unit. This unit is called the master unit, the others are called slaves.

Connect the photocell to TB1-1 and TB1-2 on the master power converter. The photocell terminals TB1-1 and TB1-2 on the slave power converters are jumpered together. Also, you connect the master unit (to which the photocell is directly connected) to the top flashhead and top tier of markers.

Master/Slave Interconnect Wiring

In a triple-unit system, the master unit and slave units communicate over the “master/slave” interconnect wiring. The master and slave power converters are connected together for communication at the master/slave interconnect terminals TB1-4 and TB1-5 on the main panel. The recommended size wiring for this purpose is #16 AWG. Twist the wires together to form a twisted pair at the rate of 12 twists per foot.

Alarm Relay Wiring

The wiring for alarm relay connections in Figure 2-6 minimizes the possibility of damage caused by high voltage transients.

Installation Checklist

Complete the following steps before applying power to the lights.

1. Inspect all equipment for damage.
2. Verify the received equipment against the packing list to ensure completeness.
3. Power Converter Mounting:

   Position and mount each unit correctly, allowing adequate clearance for opening the covers. Use the following checks:

   - Ensure that the case is mounted upright, is water tight, and grounded.
   - Check hardware inside the case to ensure that the mounting screws and nuts are tight.
   - Ensure that only the bottom of the case has drain holes and that they are clear.
   - Ensure that no holes are punched or drilled on the top surface of the case.
   - Ensure that air can flow around the case.
   - Mount the power converter away from radio frequency interference (RFI).
4. Flashhead Mounting
   - Ensure that the flashhead lens can be opened without striking other objects.
   - Level and aim the flashhead.
5. Photocell Mounting
   - Locate photocell where it views unobstructed polar sky with no direct or reflected artificial lighting striking it.
   - Mount the photocell vertically on the top end of a vertical length of conduit to prevent water from entering the unit.
6. Marker Mounting (Sidelights):
   - Ensure that marker junction boxes are mounted with the weep holes down.
   - Ensure that the junction boxes are water tight.
7. Power Converter Wiring

   Examine the installation drawings and use the following checks:

   - Check for proper incoming service voltage.
   - Wire each unit according to the instructions.
   - In triple installations, all power converters must be wired to the same electrical phase. Wire all three power converters to one 20-amp. circuit breaker.
   - Check all electrical connections for tightness.
   - Check all terminal strip connections for tightness.
   - Ground the power converter case to the site lightning ground system.
   - Wires at TB1-4 and TB1-5 should be daisy-chained as a twisted pair between the master power converter and the slave units. The rate of twist is 12 per foot. If a shielded cable is used, ground the shield. Ensure that TB1-4 is connected to all TB1-4 connections on all units, and TB1-5 is similarly connected.
8. Flashhead Wiring
   - Protect the top flashhead against lightning strikes.
   - Ground the flashhead.
   - Check the wiring of the flashhead cable to the flashhead.
   - Secure the flashhead cable to the tower. Support and tape the flashhead cable to prevent its movement by the wind.
9. Photocell Wiring
   - Connect the photocell to the master power converter: the black wire to TB1-1 and the white wire to TB1-2.

- Ensure that TB1-1 and TB1-2 on the slave units are jumpered together.

10. Alarm Wiring

- If external alarm detection circuit responds to closed contacts, ensure that they are wired to the contacts on TB1 that close on alarm.
- If external alarm detection circuit responds to open contacts, ensure that they are wired to the contacts on TB1 that open on alarm.
- Alarm wiring should be lightning and RFI protected: shielded, grounded shield, and in a conduit.
- If a specific alarm is ganged together from all power converters as one, ensure that the wiring follows local installation instructions.

11. Marker Wiring (Sidelights)

- Ensure that each power converter powers only one tier of markers.
- Ensure that the top tier of markers is wired to the master power converter.
- Check the wiring gauge to the markers to ensure less than 3% voltage drop at the sockets
- Ensure that all markers have all their lamps installed.
- Ensure that marker lamps are 116 Watts only.

After completing all the steps listed above, turn on the power and perform an operational check-out from procedures in Section 3 of this manual.

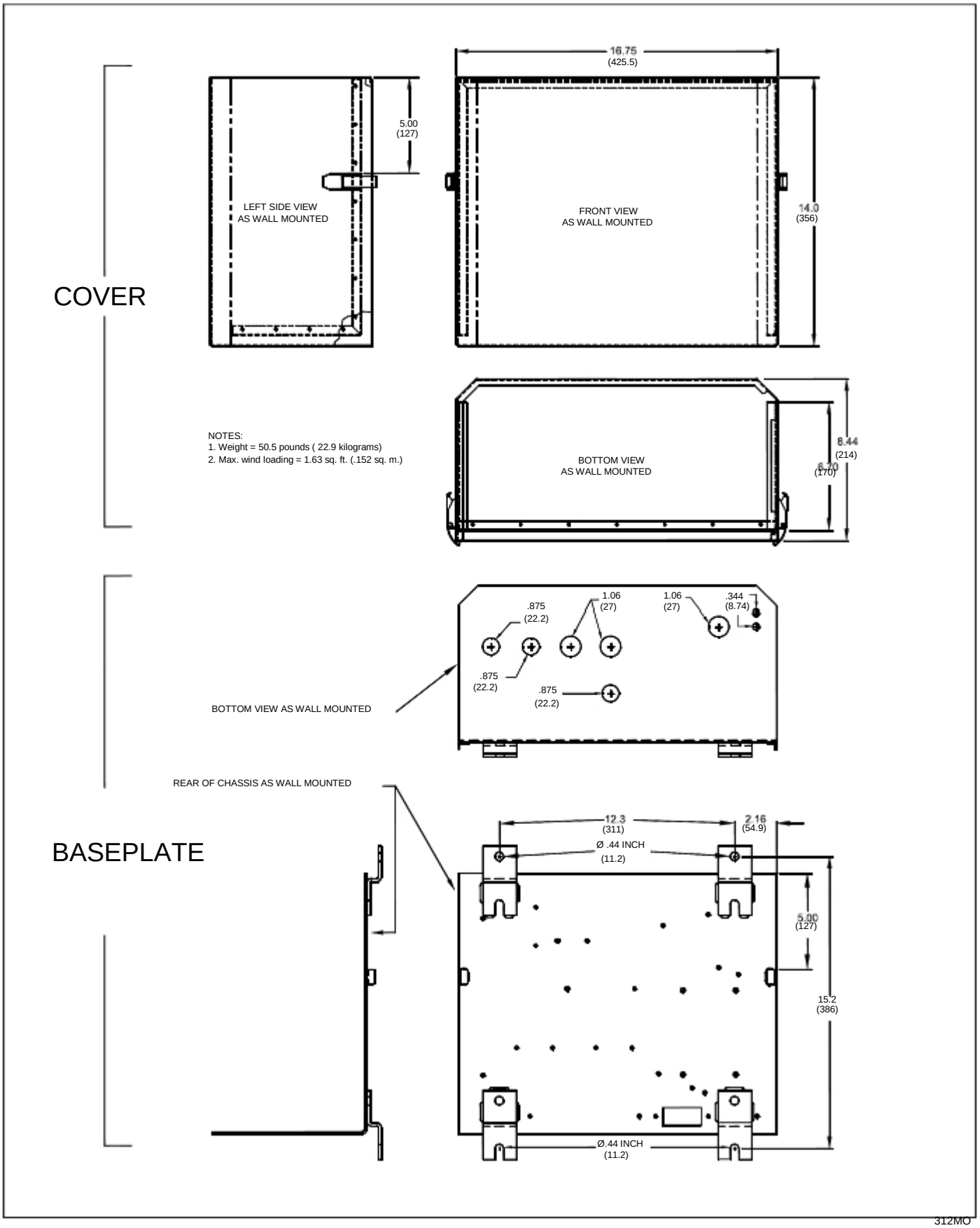
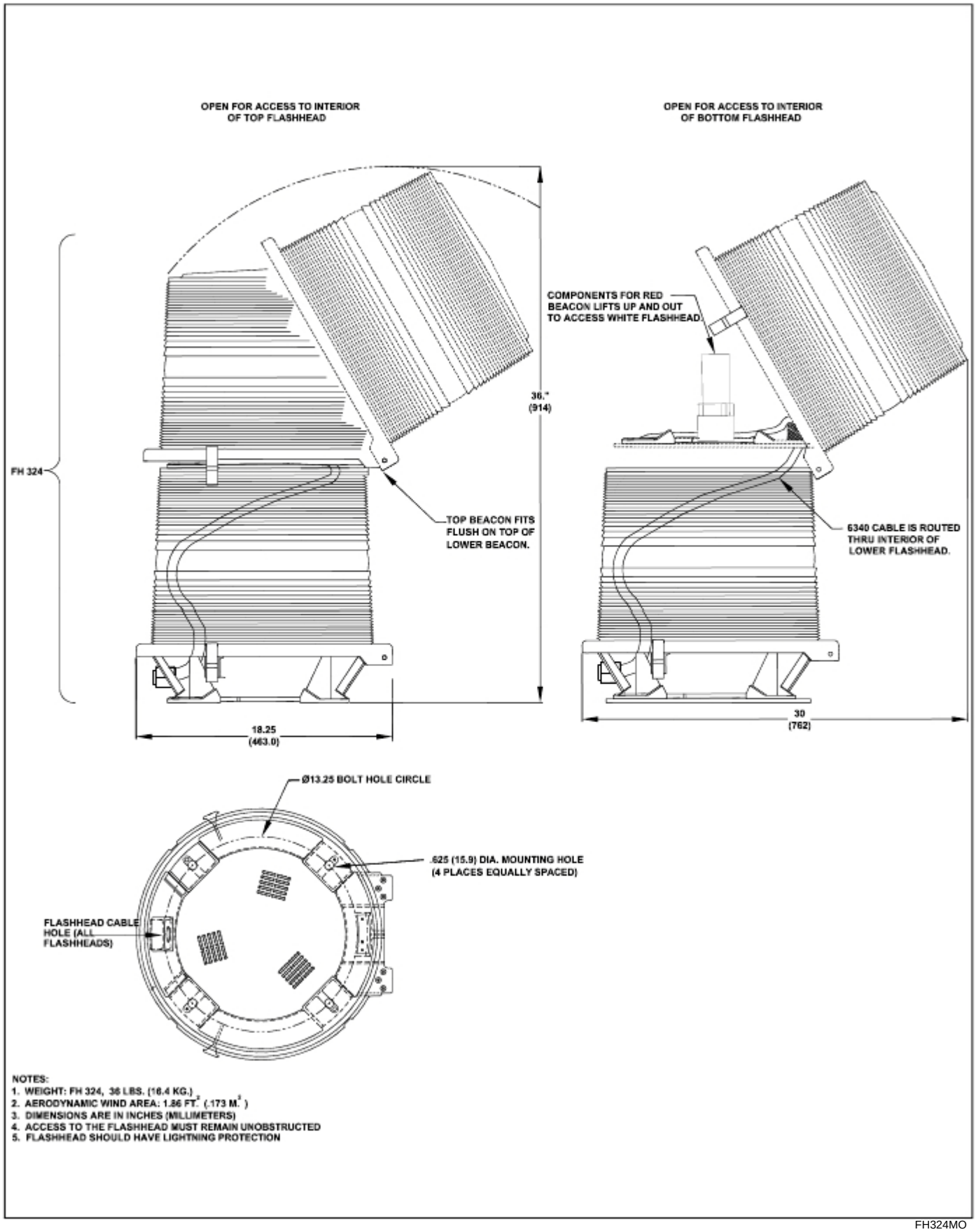
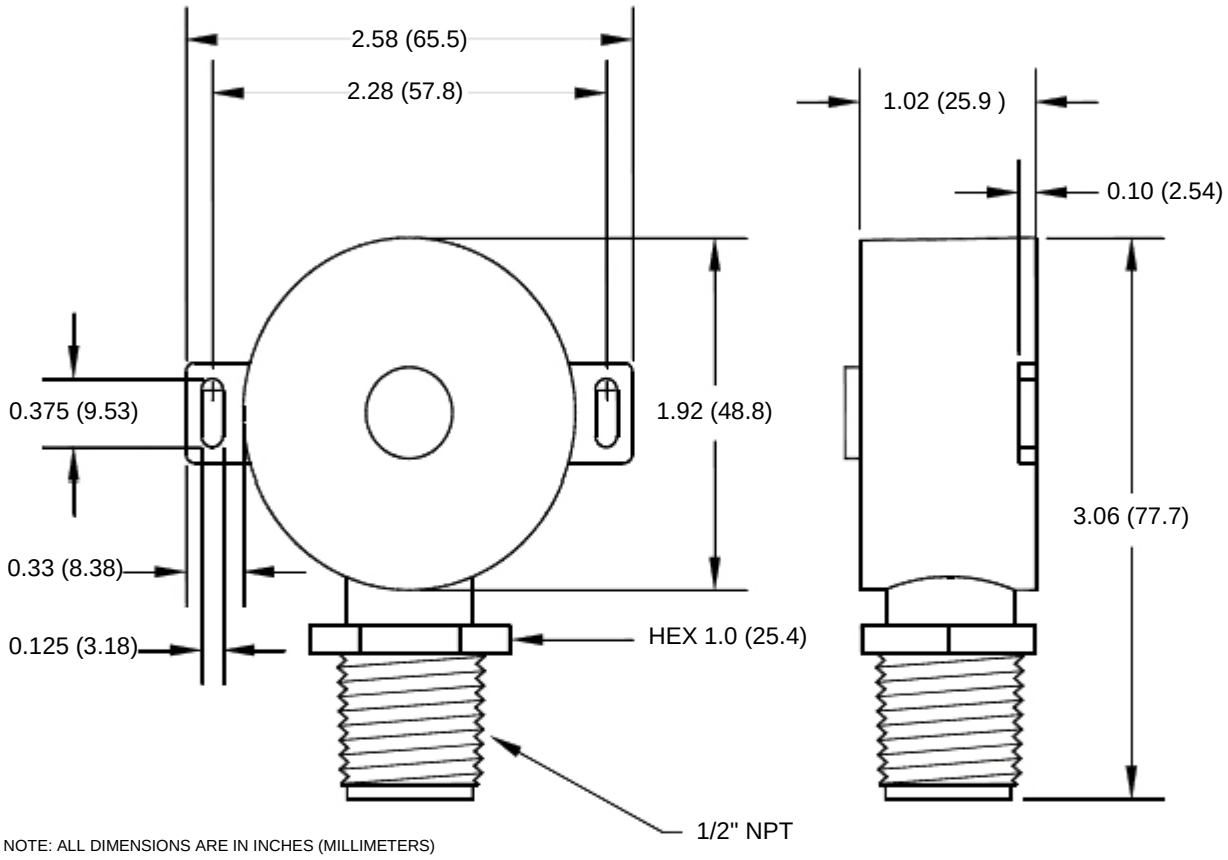


Figure 2-1 PC 324 Power Converter Mounting and Outline


OPEN FOR ACCESS TO INTERIOR OF TOP FLASHHEAD
OPEN FOR ACCESS TO INTERIOR OF BOTTOM FLASHHEAD
FH 324
36."
(914)
TOP BEACON FITS FLUSH ON TOP OF LOWER BEACON.
18.25
(463.0)
COMPONENTS FOR RED BEACON LIFTS UP AND OUT TO ACCESS WHITE FLASHHEAD.
6340 CABLE IS ROUTED THRU INTERIOR OF LOWER FLASHHEAD.
30
(762)
Ø13.25 BOLT HOLE CIRCLE
.625 (15.9) DIA. MOUNTING HOLE
(4 PLACES EQUALLY SPACED)
FLASHHEAD CABLE HOLE (ALL FLASHHEADS)
NOTES:
1. WEIGHT: FH 324, 36 LBS. (16.4 KG.)
2. AERODYNAMIC WIND AREA: 1.86 FT.² (.173 M.²)
3. DIMENSIONS ARE IN INCHES (MILLIMETERS)
4. ACCESS TO THE FLASHHEAD MUST REMAIN UNOBSTRUCTED
5. FLASHHEAD SHOULD HAVE LIGHTNING PROTECTION

FH324MO

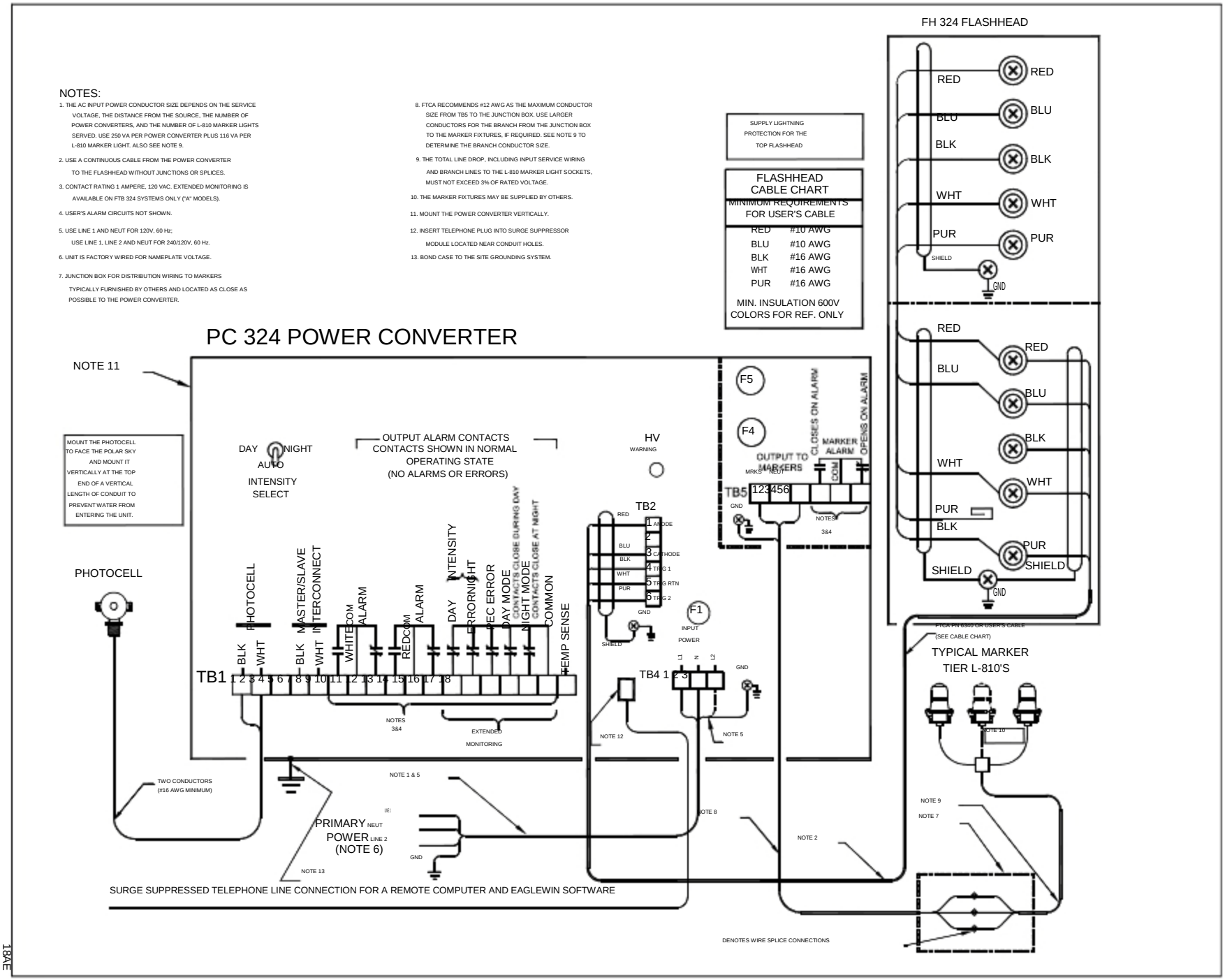
Figure 2-2 FH 324 Flashhead Mounting and Outline



PEC510MO

Figure 2-3 PEC 510 Photocell Mounting and Outline

Figure 2-4 FTB 324 Single Unit System Installation Wiring


NOTES:
1. THE AC INPUT POWER CONDUCTOR SIZE DEPENDS ON THE SERVICE VOLTAGE, THE DISTANCE FROM THE SOURCE, THE NUMBER OF POWER CONVERTERS, AND THE NUMBER OF L-810 MARKER LIGHTS SERVED. USE 250 VA PER POWER CONVERTER PLUS 116 VA PER L-810 MARKER LIGHT. ALSO SEE NOTE 9.
2. USE A CONTINUOUS CABLE FROM THE POWER CONVERTER TO THE FLASHHEAD WITHOUT JUNCTIONS OR SPLICES.
3. CONTACT RATING 1 AMPERE, 120 VAC. EXTENDED MONITORING IS AVAILABLE ON FTB 324 SYSTEMS ONLY ("A" MODELS).
4. USER'S ALARM CIRCUITS NOT SHOWN.
5. USE LINE 1 AND NEUT FOR 120V, 60 Hz; USE LINE 1, LINE 2 AND NEUT FOR 240/120V, 60 Hz.
6. UNIT IS FACTORY WIRED FOR NAMEPLATE VOLTAGE.
7. JUNCTION BOX FOR DISTRIBUTION WIRING TO MARKERS TYPICALLY FURNISHED BY OTHERS AND LOCATED AS CLOSE AS POSSIBLE TO THE POWER CONVERTER.
8. FTCA RECOMMENDS #12 AWG AS THE MAXIMUM CONDUCTOR SIZE FROM TB5 TO THE JUNCTION BOX. USE LARGER CONDUCTORS FOR THE BRANCH FROM THE JUNCTION BOX TO THE MARKER FIXTURES, IF REQUIRED. SEE NOTE 9 TO DETERMINE THE BRANCH CONDUCTOR SIZE.
9. THE TOTAL LINE DROP, INCLUDING INPUT SERVICE WIRING AND BRANCH LINES TO THE L-810 MARKER LIGHT SOCKETS, MUST NOT EXCEED 3% OF RATED VOLTAGE.
10. THE MARKER FIXTURES MAY BE SUPPLIED BY OTHERS.
11. MOUNT THE POWER CONVERTER VERTICALLY.
12. INSERT TELEPHONE PLUG INTO SURGE SUPPRESSOR MODULE LOCATED NEAR CONDUIT HOLES.
13. BOND CASE TO THE SITE GROUNDING SYSTEM.
SUPPLY LIGHTNING PROTECTION FOR THE TOP FLASHHEAD
FLASHHEAD CABLE CHART
MINIMUM REQUIREMENTS FOR USER'S CABLE
RED #10 AWG
BLU #10 AWG
BLK #16 AWG
WHT #16 AWG
PUR #16 AWG
MIN. INSULATION 600V
COLORS FOR REF. ONLY
FH 324 FLASHHEAD
RED
BLU
BLK
WHT
PUR
SHIELD
GND
PC 324 POWER CONVERTER
NOTE 11
MOUNT THE PHOTOCELL TO FACE THE POLAR SKY AND MOUNT IT VERTICALLY AT THE TOP END OF A VERTICAL LENGTH OF CONDUIT TO PREVENT WATER FROM ENTERING THE UNIT.
PHOTOCELL
DAY
NIGHT
AUTO
INTENSITY SELECT
OUTPUT ALARM CONTACTS
CONTACTS SHOWN IN NORMAL OPERATING STATE
(NO ALARMS OR ERRORS)
HV WARNING
TB1 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18
PHOTOCELL
MASTER/SLAVE INTERCONNECT
WHITECOM ALARM
REDCOM ALARM
INTENSITY
DAY
ERRORNIGHT
REC ERROR
DAY MODE CONTACTS CLOSE DURING DAY
NIGHT MODE CONTACTS CLOSE AT NIGHT
COMMON
TEMP SENSE
BLK
WHT
NOTES 3&4
EXTENDED MONITORING
TB2
1 AMODE
2
3 CATHODE
4 TRG 1
5 TRG RTN
6 TRG 2
F1
INPUT POWER
TB4 1 2 3
L1 N L2
F5
F4
CLOSES ON ALARM
MARKER ALARM
OPENS ON ALARM
OUTPUT TO MARKERS
MRKS NEUT
COM
TB5 1 2 3 4 5 6
FTCA P/N 6340 OR USER'S CABLE (SEE CABLE CHART)
TYPICAL MARKER TIER L-810'S
NOTE 10
NOTE 9
NOTE 7
NOTE 8
NOTE 2
NOTE 12
NOTE 5
NOTE 1 & 5
NOTE 13
TWO CONDUCTORS (#16 AWG MINIMUM)
PRIMARY POWER (NOTE 6)
NEUT
LINE 2
SURGE SUPPRESSED TELEPHONE LINE CONNECTION FOR A REMOTE COMPUTER AND EAGLEWIN SOFTWARE
DENOTES WIRE SPLICE CONNECTIONS
18AE

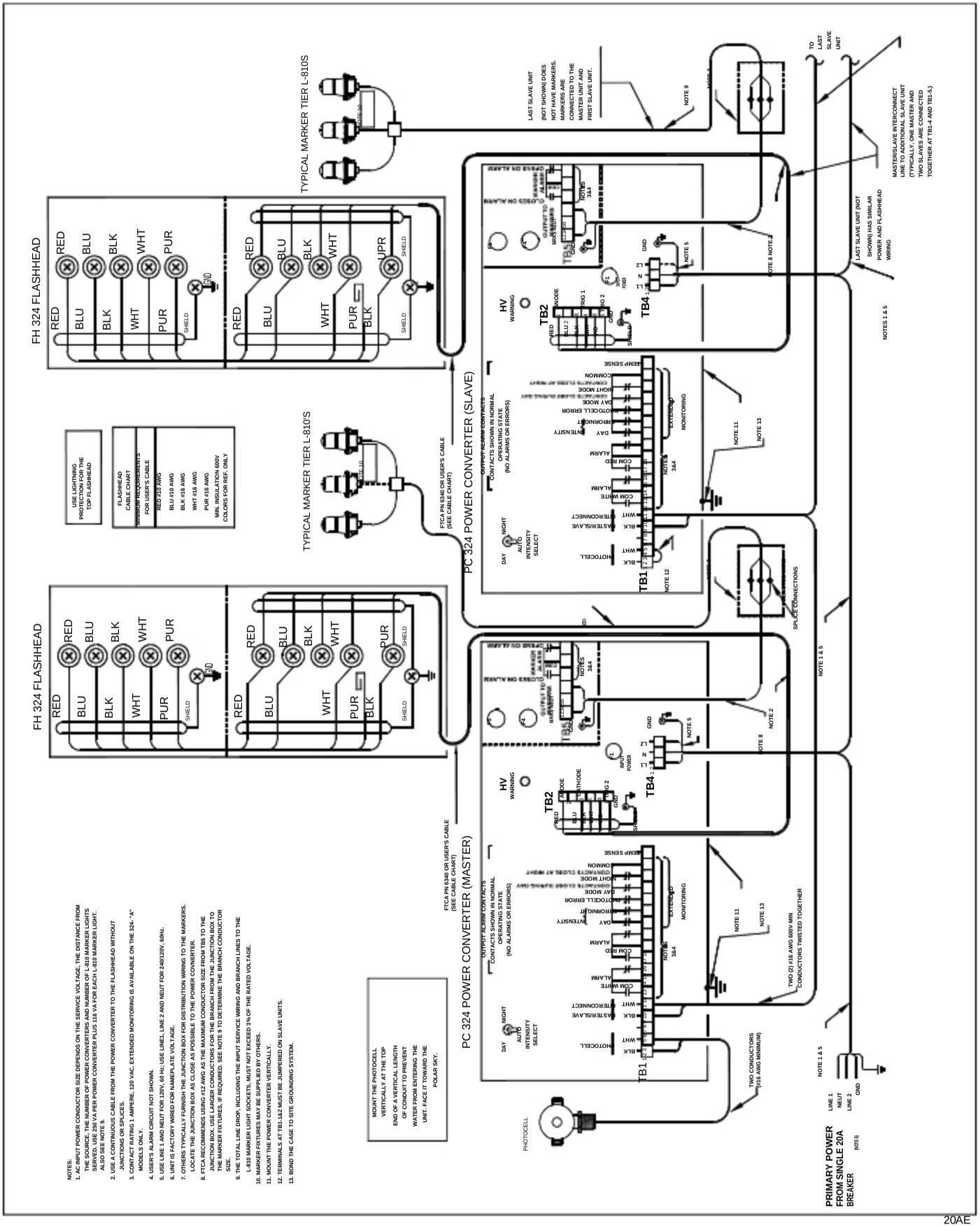
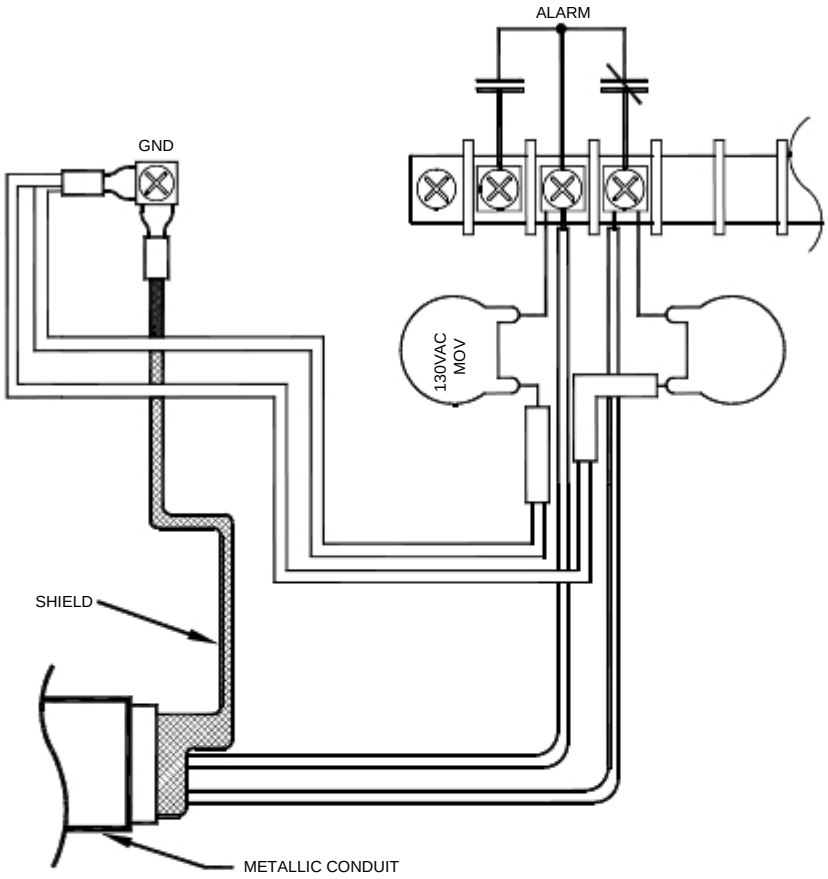

FH 324 FLASHHEAD
RED
BLU
BLK
WHT
PUR
SHIELD
GND
TYPICAL MARKER TIER L-810S
TYPICAL MARKER TIER L-810'S
PC 324 POWER CONVERTER (SLAVE)
PC 324 POWER CONVERTER (MASTER)
FTCA PN 6340 OR USER'S CABLE (SEE CABLE CHART)
USE LIGHTNING PROTECTION WITH THE TOP FLASHHEAD
FLASHHEAD CABLE CHART
MINIMUM REQUIREMENTS FOR USER'S CABLE
RED #18 AWG
BLU #10 AWG
BLK #16 AWG
WHT #16 AWG
PUR #16 AWG
MIN. INSULATION 600V
COLORS FOR REF. ONLY
MOUNT THE PHOTOCELL VERTICALLY, AT THE TOP END OF A VERTICAL LENGTH OF CONDUIT TO PREVENT WATER FROM ENTERING THE UNIT. FACE IT TOWARD THE POLAR SKY.
PHOTOCELL
TWO CONDUCTORS (#16 AWG MINIMUM)
TWO (2) #16 AWG 600V MIN CONDUCTORS TWISTED TOGETHER
LAST SLAVE UNIT (NOT SHOWN) DOES NOT HAVE MARKERS. MARKERS ARE CONNECTED TO THE MASTER UNIT AND FIRST SLAVE UNIT.
LAST SLAVE UNIT (NOT SHOWN) HAS SIMILAR POWER AND FLASHHEAD WIRING
MASTER/SLAVE INTERCONNECT LINE TO ADDITIONAL SLAVE UNIT (TYPICALLY, ONE MASTER AND TWO SLAVES ARE CONNECTED TOGETHER AT TB1-4 AND TB1-5.)
TO LAST SLAVE UNIT
SPLICE CONNECTIONS
PRIMARY POWER FROM SINGLE 20A BREAKER
LINE 1
NEUT
LINE 2
GND
TB1
TB2
TB4
HV WARNING
INPUT POWER
DAY
NIGHT
AUTO
INTENSITY SELECT
HOTOCELL
MASTER/SLAVE INTERCONNECT
COM WHITE ALARM
COM RED ALARM
DAY INTENSITY
NIGHT
PHOTOCELL ERROR
DAY MODE
NIGHT MODE
COMMON
TEMP SENSE
NOTES 3&4
EXTENDED MONITORING
NOTE 1 & 5
NOTE 2
NOTE 5
NOTE 8
NOTE 9
NOTE 11
NOTE 12
NOTE 13
NOTES:
1. AC INPUT POWER CONDUCTOR SIZE DEPENDS ON THE SERVICE VOLTAGE, THE DISTANCE FROM THE SOURCE, THE NUMBER OF POWER CONVERTERS AND NUMBER OF L-810 MARKER LIGHTS SERVED. USE 250 VA PER POWER CONVERTER PLUS 116 VA FOR EACH L-810 MARKER LIGHT. ALSO SEE NOTE 9.
2. USE A CONTINUOUS CABLE FROM THE POWER CONVERTER TO THE FLASHHEAD WITHOUT JUNCTIONS OR SPLICES.
3. CONTACT RATING 1 AMPERE, 120 VAC. EXTENDED MONITORING IS AVAILABLE ON THE 224- "A" MODELS ONLY.
4. USER'S ALARM CIRCUIT NOT SHOWN.
5. USE LINE 1 AND NEUT FOR 120V, 60 Hz; USE LINE1, LINE 2 AND NEUT FOR 240/120V, 50Hz.
6. UNIT IS FACTORY WIRED FOR NAMEPLATE VOLTAGE.
7. OTHERS TYPICALLY FURNISH THE JUNCTION BOX FOR DISTRIBUTION WIRING TO THE MARKERS. LOCATE THE JUNCTION BOX AS CLOSE AS POSSIBLE TO THE POWER CONVERTER.
8. FTCA RECOMMENDS USING #12 AWG AS THE MAXIMUM CONDUCTOR SIZE FROM TB5 TO THE JUNCTION BOX. USE LARGER CONDUCTORS FOR THE BRANCH FROM THE JUNCTION BOX TO THE MARKER FIXTURES, IF REQUIRED. SEE NOTE 9 TO DETERMINE THE BRANCH CONDUCTOR SIZE.
9. THE TOTAL LINE DROP, INCLUDING THE INPUT SERVICE WIRING AND BRANCH LINES TO THE L-810 MARKER LIGHT SOCKETS, MUST NOT EXCEED 3% OF THE RATED VOLTAGE.
10. MARKER FIXTURES MAY BE SUPPLIED BY OTHERS.
11. MOUNT THE POWER CONVERTER VERTICALLY.
12. TERMINALS AT TB1-1&2 MUST BE JUMPERED ON SLAVE UNITS.
13. BOND THE CASE TO SITE GROUNDING SYSTEM.
20AE

Figure 2-5 FTB 324 Triple Unit System Installation Wiring



CUSTOMER CONNECTION TO ALARM RELAY CONTACTS

FLASH TECHNOLOGY ALARM RELAY CONTACTS ARE PROTECTED FROM VOLTAGE TRANSIENTS OF UP TO 1000 VOLTS. HOWEVER, WIRED ALARM CONTACTS CAN BE SUBJECTED TO VOLTAGES GREATER THAN 1000 VOLTS BECAUSE OF LIGHTNING. THE FOLLOWING RECOMMENDATIONS MINIMIZE THE POSSIBILITY OF DAMAGE CAUSED BY HIGH VOLTAGE TRANSIENTS ON THE ALARM RELAY CONTACTS OF FLASH TECHNOLOGY POWER CONVERTERS.

THE INSTALLER IS RESPONSIBLE FOR COMPLYING WITH ALL APPLICABLE ELECTRICAL CODES.

NOTES:

- USE SHIELDED CABLE TO ATTACH FLASH TECHNOLOGY ALARM RELAY CONTACTS TO EXTERNAL EQUIPMENT.
- ATTACH THE SHIELD WIRE TO A GND (GROUND) TERMINAL ON THE FLASH TECHNOLOGY POWER CONVERTER AS SHOWN.
- WHEN POSSIBLE, ROUTE ALARM CONTACT WIRING IN METALLIC, GROUNDED CONDUIT.
- FOR ADDITIONAL PROTECTION, ADD MOVs (VARISTORS) FROM EACH ALARM RELAY CONTACT TERMINAL TO A GND TERMINAL AT THE FLASH TECHNOLOGY POWER CONVERTER.

ALRM2

Figure 2-6 Recommended Alarm Relay Wiring Protection

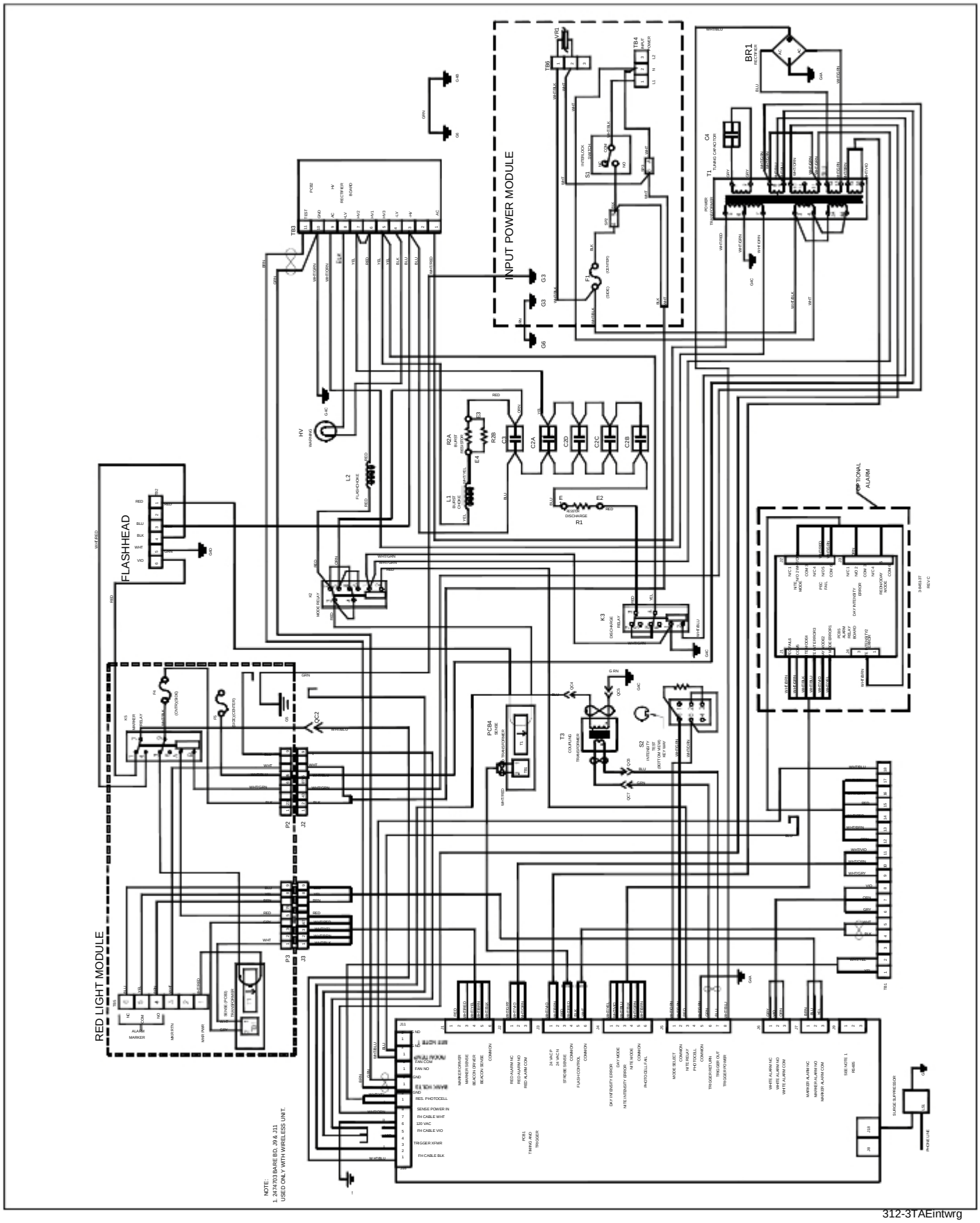
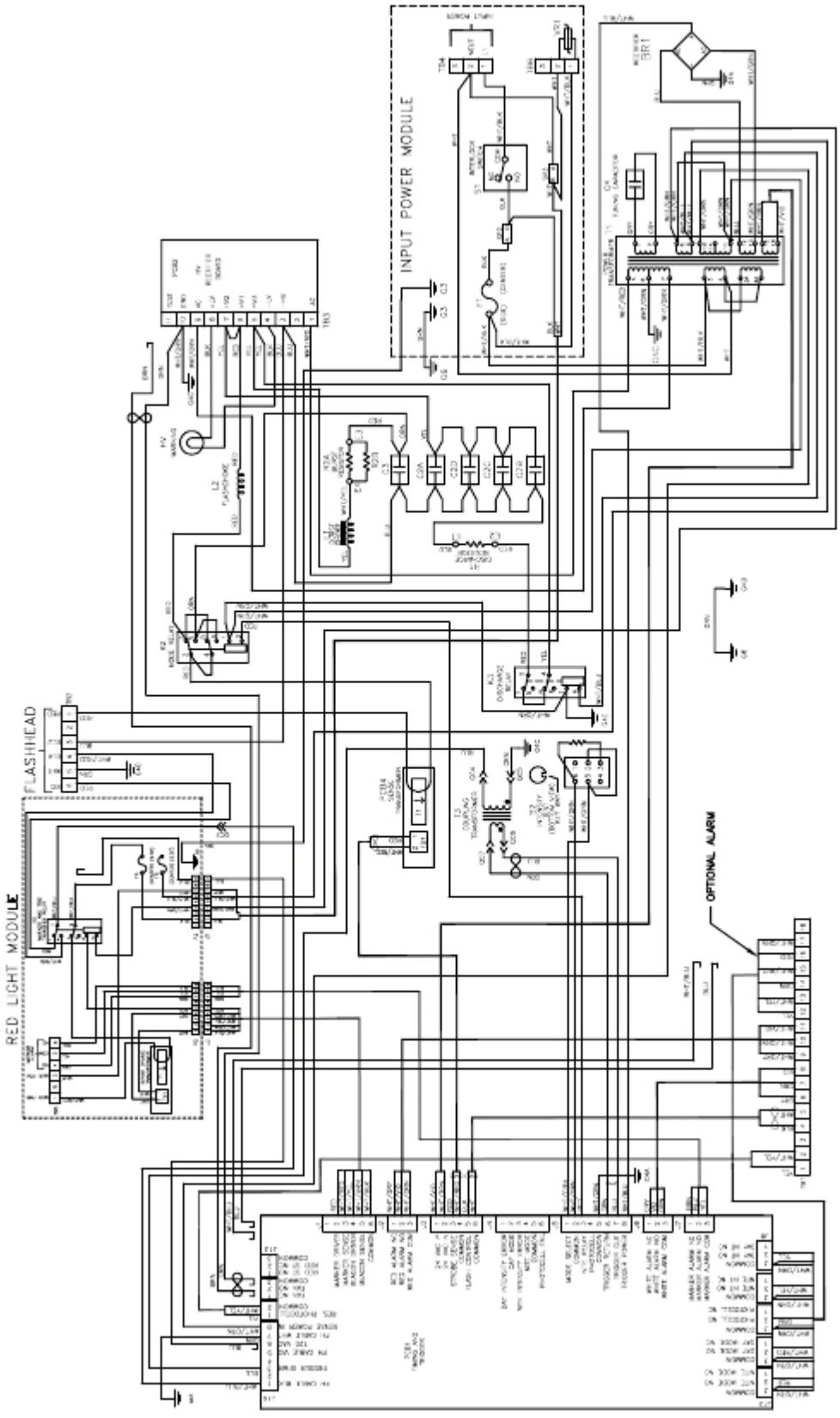
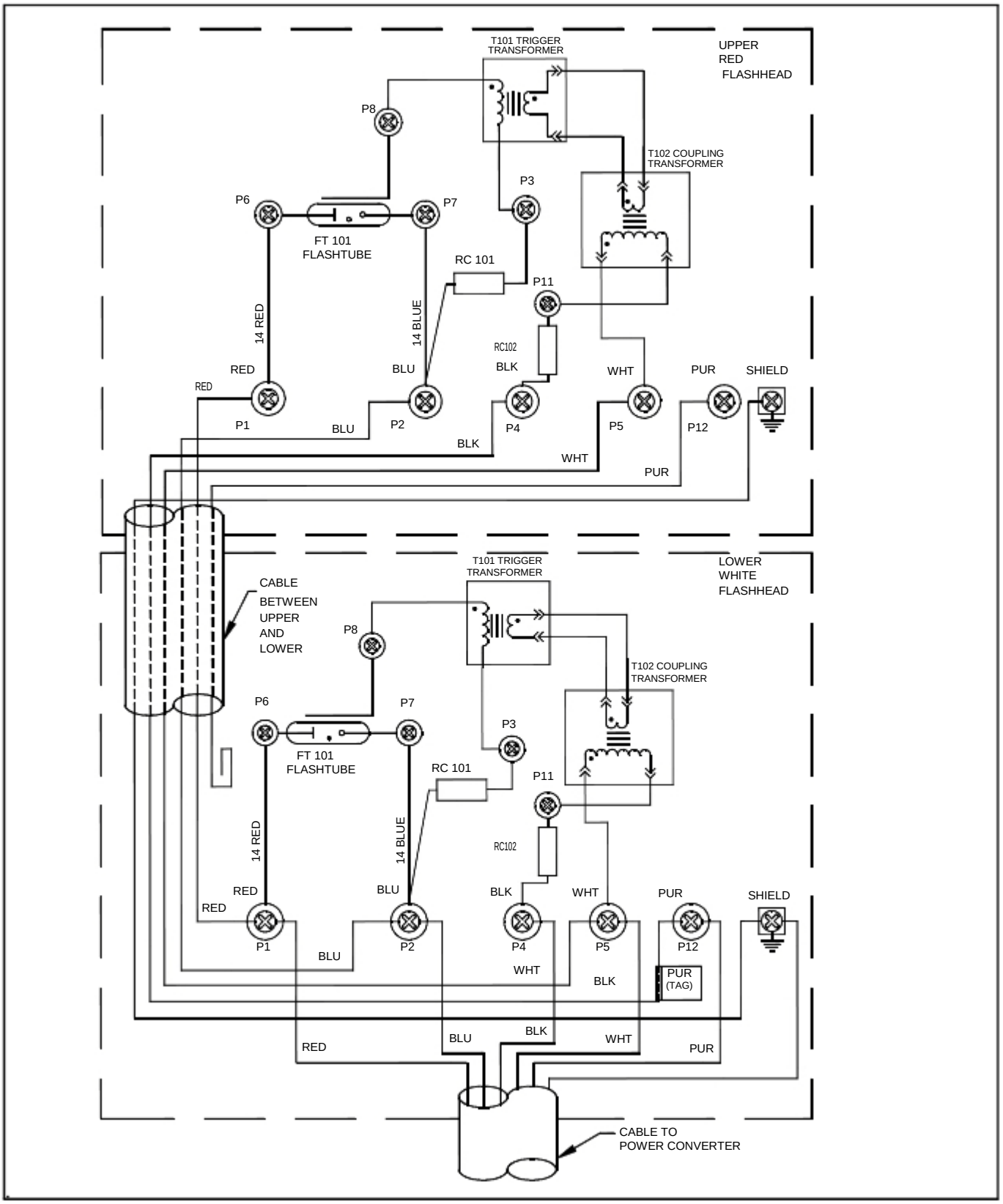


Figure 2-7 PC 324AE Power Converter Internal Wiring



3845112k

Figure 2-8 PC 324 Power Converter Internal Wiring



fh324iw

Figure 2-9 FH 324 Flashhead Internal Wiring

Section 3 — Maintenance and Troubleshooting

Safety

Read the warning on Page iii. Work safely as follows:

1. Remove all jewelry before opening equipment.
2. Shut off the equipment.
3. Remove component or connect test equipment.
4. Replace the component.
5. Turn on the power and test the system.
6. Turn off power and disconnect test equipment.

Preventive Maintenance

Carry out the following inspection and cleaning procedures at least once a year:

1. Verify that moisture has not entered the equipment through gaskets or seals, or collected inside as condensation.
2. Verify that all drain holes are clear.
3. Check terminal blocks and relays for evidence of corrosion and electrical arcing. Clean or replace any component that shows evidence of high-voltage damage.
4. Check flashtube connections for signs of pitting or arcing. Verify that anode and cathode connections are firmly tightened.
5. Check all electrical connections for tightness and verify the absence of corrosion or electrical arcing.
6. Clean the outside surface of the lens with liquid detergent and water. Wipe it gently with a soft cloth or paper towel.
7. Clean the inside surface of the lens with an FTCA-approved professional plastic cleaner. Wipe the lens with cheesecloth only. Do not use regular cloth or paper towels. A lens cleaning kit, Part Number 8630801, is available from FTCA.

Storage

No special considerations are required for long-term storage of any major assembly, such as the power converter, flashhead, photocell or any internal component. Circuit boards, when not installed in the equipment, should be kept in anti-static bags or containers.

Diagnostic Testing

Basic functional testing procedures follow. The only effective way to check out interconnected power converters is to disconnect the wire labeled master/slave interconnect that is connected to TB1-4 and check them as single units, as described in the subsection Checkout Procedures.

Sync Signal Evaluation

Refer to Figure 2-5. Note that, for each power converter, a master/slave interconnect line and its return line are connected to TB1-4 and TB1-5 respectively. All units place a sync pulse on the line; the first sync pulse on the line synchronizes the remaining lights to flash all the lights at the same time. PCB1 in each power converter generates a sync pulse. The width of the sync pulse controls the mode of operation.

The top light must be operated by the master power converter and the photocell must be connected to the master power converter. In the event of a top red light failure at night, the master power converter places a back-up signal on the line that causes all connected units to flash the white lights at the correct night intensity.

The sync signal is a pulse and difficult to evaluate with a meter. Different meters respond differently. You may detect the sync pulse as an instantaneous movement of the meter indicator. A digital meter with a max-min function may capture part of the pulse. This is generally a sufficient indication of a pulse being present. (A 24V pulse of 16 ms. width might read 12V on a 100 ms. capture time of max-min function.)

RFI Problems

Radio frequency interference (RFI) can cause a light to flash intermittently, at the wrong rate, or at the wrong intensity. RFI can enter the light by any wire to or from the unit. For example:

- RFI on primary power wires could cause errors in flash rate and intensity.
- RFI on the master/slave interconnecting wire could cause a light to switch to and remain in night intensity.
- RFI on the photocell line could switch a light to night intensity and force it to remain there. RFI would not normally cause a light to switch to day intensity.
- Strong RFI could burn out circuit board components.

While FTCA designed the circuits to reject or bypass RFI, FTCA cannot guarantee complete immunity beforehand. After installation, it may be necessary to add external filters or use other methods to reduce RFI entering the equipment.

Component Testing

The following procedures describe how to check most of the unit's major electrical components. Always make resistance measurements with the primary power turned off. Before applying power for voltage measurements, connect test leads or circuit jumpers, or disconnect existing circuit connections, with the power turned off and storage capacitors discharged.

Wiring and Cabling

Wires or cables that move repeatedly will eventually break. Ensure that all cables (the flashhead cable in particular) are securely fastened at short intervals to the structure or other supports.

Inspection

Closely inspect the units and check the connections against the installation instructions. Also, a close inspection may reveal insulation breakdown, an overheated component, corrosion, loose connections, faulty relays, incorrect hookup, and so forth.

Power Converter Component Testing

Capacitors

Evaluate the condition of a capacitor with an analog volt-ohmmeter operating in the resistance mode. The following method assumes an instrument with a X100 resistance scale.

Place the meter leads across the terminals of an isolated (no electrical connections to other circuits) and fully discharged capacitor. Observe the subsequent needle movement.

If the capacitor is functional, the needle initially indicates zero ohms, but soon begins to rise to higher indicated values. A capacitor that is disconnected from other circuitry is defective if it does not exhibit this behavior. The length of time it takes the needle to reach the 1-megohm reading (about 65% full-scale) is a measure of the capacitance. For example, the time is about 5 seconds for a 10-mfd. capacitor, or 10 seconds for a 20-mfd. capacitor, and so forth.

Manually discharge the capacitor before repeating this measurement. This test may not detect a malfunction that occurs only at high voltage.

A bank of capacitors connected in parallel may be checked as a single unit. If the test indicates a short circuit, the individual capacitors have to be disconnected and checked separately. A shorted capacitor is indicated if the resistance does not rise above zero after several seconds of measurement.

Burst Choke (L1)

The measured resistance of this choke should be approximately seven ohms.

Relays

A malfunctioning relay may have faulty contacts, a sticky mechanism, a bad ground, or a defective coil. You may determine the first two possibilities by inspection and manually exercising the armature. You can confirm a defective coil by measuring the resistance. To measure the resistance of relay coils, first remove the wires from one of the connections to the coil terminals on the relay.

Mode Relay (K2): 24 VDC; 290 ohm coil

Discharge Relay (K3): 120 VAC; 290 ohm coil

Timing and Trigger Board (PCB1)

Replace this board with one known to be in good condition. Note that the PCB1 board part numbers in this manual are either 24740xx or 24747xx. Call Customer Service for technical assistance at 1-800-821-5825.

PCB1 part numbers vary. Be certain that you have the complete number available, which is imprinted and written on your board.

HV Rectifier Board (PCB2)

Replace this board with one known to be in good condition.

Alarm Relay Board (PCB5) (PC 324)

Replace this circuit board with one known to be in good condition.

Sense Module (PCB4)

Replace this circuit board with one known to be in good condition.

Discharge Resistor (R1)

The measured resistance of this component should be 35,000 ohms.

Burst Resistor (R2)

The measured resistance of this component should be 250 ohms (two 500-ohm resistors in parallel)

Power Transformer (T1)

To test this transformer, first remove PCB1 and PCB2. Apply power to the unit and measure secondary winding voltages at the terminals indicated in Table 3-1.

Table 3-1 T1 Transformer Voltages

Terminals	Voltage Range
TB3-1 to TB3-9	900-1050 volts AC*
PCB1 J5-8 to chassis	100-120 volts DC
PCB1 J3-1 to J3-2	22-26 volts AC

* If this AC voltage is substantially below the specified minimum value, check tuning capacitor C4.

Trigger Coupling Transformer (T3)

The coupling transformer should not have open windings. An ohmmeter will indicate a shorted winding because of wire size. Check with an ohmmeter at the wire terminals. Check upper and lower ferrite core pieces for cracks.

Red Light Module Components

Marker Relay (K5): 24 VDC; 470 ohm coil. Replace the entire Red Light Module to replace the relay.

Marker Sense Transformer (T1 on PCB3): The Marker Sense Transformer is mounted on PCB3. If you suspect the transformer, replace the entire Red Light Module.

Flashhead Component Testing

The following subsections describe component testing for the components in the flashhead.

Flashtube (FT101)

Visually inspect the flashtube for broken electrodes, cracked glass, and the solder connections of the pins. A darkened envelope does not necessarily mean the light output would be unacceptable. Before concluding that a faulty flashtube is responsible for an inadequate flash, first rule out other possible causes such as weak or absent discharge voltage or triggering pulses.

Trigger Transformer (T101)

The resistance of the secondary winding (potted assembly) should be approximately 160 ohms. Check the upper and lower ferrite core pieces for cracks. Check the mounting screws for tightness.

Trigger Coupling Transformer (T102)

The coupling transformer should not have open windings. An ohmmeter will indicate a shorted winding because of wire size. Check with an ohmmeter at the wire terminals. Check upper and lower ferrite core pieces for cracks.

Photocell Testing

The photocell is wired directly to the master power converter at TB1-1 and TB1-2.

1. Disconnect the photocell. The system should go to nighttime operation in about 45 seconds.
2. Disconnect the master/slave interconnect line on each power converter.
3. Operate the intensity control switch on each power converter in turn.
4. If each power converter operates correctly with the intensity control switch, the problem is the photocell, or its wiring, or troubleshoot the circuits in the erroneously operating power converter.
5. Reconnect all wires.

With the Intensity Select Switch in AUTO during daylight, completely block light from entering the photocell. If the system does not enter night mode after a few minutes, replace the photocell. At night, shine a light on the photocell, if the system does not enter day mode after a few minutes, replace the photocell.

Component Removal and Replacement

Component location diagrams are provided in Figure 4-1, through Figure 4-3 in Section 4 — Recom-

mended Spare and Replaceable Parts. Internal electrical wiring diagrams are provided in Section 2 and on the Information Card that is fastened inside the power converter cover.

Note the location and color of all wires that you disconnect. When you replace the wiring after you replace the components, ensure that the wiring conforms exactly to the wiring diagrams.

The general procedure for removing components is a logical one and is as follows:

1. Obtain access to the component in question:
   a. Disconnect completely or partially the wiring to components first that prevent clear access.
   b. Completely remove or relocate these components.
3. Disconnect the wiring to the component that you want to replace.
4. Remove this component.
5. Replace everything in the reverse order: first the component, then the wiring, then the components that allowed you access. In some cases, you may have to place some wires on the component before you fasten it in place, then replace the remaining wires.

Most components are relatively easy to access for removal. Only those that are more difficult are described.

Power Converter

Capacitors

Before removing or replacing a capacitor always ensure it is discharged by checking with a voltmeter directly across the terminals. Discharge a capacitor by placing a resistance (25 watts/10,000 ohms or greater) between its terminals. Direct shorting may damage the capacitor, and connecting the terminals to the equipment chassis may fail to discharge it.

Remove the fuse for this procedure to prevent accidental application of power if the interlock switch is inadvertently depressed.

Removal

1. Disconnect the wires leading to capacitors.
2. Remove the hold-down screws.
3. Lift the capacitors from their receiving holes.

Replacement

1. Reverse the removal procedure.
2. Verify that wiring agrees with the wiring diagram on the Information Card. Wires must be replaced exactly as removed. In some instances, a quick-connect wire terminal does not seat properly if it is not placed on the terminal cluster exactly as it was before removal. This occurs by interference between the insulation on the wire terminal and the insulation surrounding their terminal cluster on the capacitor. FTCA recommends that you lightly squeeze the quick-connect wire terminals with pliers before reinstalling them over the capacitor terminal blades.

Input Power Module

Removal

1. Remove all accessible wires and cable connectors attached to the Input Power Module and to T1 located under the Input Power Module.
2. Loosen the truss-head screws in the base that fasten the Input Power Module to the base.
3. Remove the screw under the ground terminal to the left of TB4. This screw fastens the Input Power Module bracket to the Component Bracket.
4. Carefully slide the Input Power Module bracket to the right and lift it out. Ensure that connectors are not bent while doing so.
5. Remove any additional connections that you must to remove the Input Power Module bracket.

Replacement

1. Replace the Input Power Module in the reverse sequence to that of Removal.
2. Verify that wiring matches the Information Card and restore the wire routing to its original state.

K2 Mode Relay

You must first remove the Red Light Module and PCB1 as in Section Red Light Module, Section Timing and Trigger Board (PCB1), and the Component Bracket for adequate access to the K2 Mode Relay.

Removal

1. Remove the Red Light Module.
2. Remove PCB1.

3. Loosen the four truss-head screws in the base that fasten the bracket to the base.
4. Loosen the screw that fastens the bracket to the Input Power Module.
5. Slide the bracket up off the screws. Be careful of the cable and cable connectors. You may hang the bracket over the edge of the connector panel to perform the remaining steps.
6. Carefully disconnect the wires from the terminals of the component and note their locations so that you may more easily replace them.
7. Remove the screws that hold the K2 relay to the base.
8. Remove the K2 relay.

Replacement

1. Replace the K2 relay in the reverse sequence of that of removal.
2. Verify that wiring matches the Information Card and restore the wire routing to its original state.

K3 Discharge Relay

Removal and replacement are similar to those in Section K2 Mode Relay.

K5 Marker Control Relay

To replace K5, replace the entire Red Light Module.

L1 Burst Choke

Removal and replacement are similar to those in Section K2 Mode Relay.

PCB1 Timing and Trigger Board

PCB1 is mounted on the left side of the power converter as you face the wall-mounted power converter.

Removal

1. Remove all connector plugs from PCB1 headers, and:
   - On J12 Pins 1 & 2 remove the wht/blu and blu wires (if present).
   - On J14 Pins 1 & 2 remove the brn and grn wires (if present).
   - On J15 Pins 1 & 2 remove the yel and wht/yel wires.
2. Loosen (but do not remove) the four screws located near the corners of the board.
3. Slide the board so that it clears the four screws and remove it from the power converter.

Replacement

Reverse the removal procedure.

PCB2 HV Rectifier Board

The HV rectifier board is mounted on the right of the Component Bracket between the Component Bracket and the Red Light Module. You access it by first removing the Red Light Module and then the Component Bracket. Use the following procedure:

Removal

1. Remove the Red Light Module.
2. If you have a right-angle Phillips-head screwdriver available, it is not necessary to remove the Component Bracket before doing Step 3. Otherwise, remove the Component Bracket.
3. Loosen, but do not remove, the screws holding the HV rectifier board to the terminal block TB3. Slide the circuit board out from under the terminal block screws.

Replacement

1. Slide the circuit board under the terminal block screws and tighten them.
2. Replace the Red Light Module.
3. Verify that wiring matches the Information Card and restore the wire routing to its original state.

PCB4 Sense Module

Removal and replacement are similar to those in Section K2 Mode Relay.

Red Light Module

Removal

1. Remove the external wires connected to TB5.
2. Unplug all harness connections to the Red Light Module.
3. Loosen two screws in the base that fasten the Red Light Module to the base.
4. Remove the Red Light Module. Be careful of components and connectors.
5. Disconnect the ground wire from the back of the module.

Replacement

1. Replace the Red Light Module in the reverse sequence to that of Removal.
2. Verify that wiring matches the Information Card and restore the wire routing to its original state.

R2A and R2B Burst Resistors

Removal and replacement are similar to those in Section K2 Mode Relay.

T1 Power Transformer

Removal

1. Remove the Input Power Module.
2. Remove the four screws holding the transformer to the base plate and remove the transformer.

Replacement

1. Replace the power transformer in the reverse sequence to that of Removal.
2. Verify that wiring matches the Information Card and restore the wire routing to its original state.

T3 Trigger Coupling Transformer

Removal

1. Remove the Red Light Module.
2. Remove PCB1.
3. Loosen the four screws that hold the Component Bracket to the base.
4. Slide the Component Bracket up off the screws. Be careful of the cable and cable connectors. You may hang the Component Bracket over the edge of the connector panel to perform the remaining steps.
5. Pay special attention to the orientation of the wires on the transformer and their connections. Replace them in the same orientation.

Replacement

1. Replace T3 in the reverse sequence to that of Removal. Note the connections to T3 as in Step 5 of the Removal, and replace the wires to their connections in the same way.
2. Verify that wiring matches the Information Card and restore the wire routing to its original state.

Flashhead

FT101 Flashtube:
Red Lens Section:

Removal

1. Unlatch the two latches and lift the red lens to allow access to the three screws holding the flashtube pins.
2. Using a #2 Phillips-blade screwdriver, loosen the three screws (on screw lugs) directly under the flashtube, which hold the flashtube connector pins. This enables you to remove the flashtube.

Replacement

1. Align the pins on the flashtube base with the clamps of the terminal screw lugs, making sure that the red dot on the flashtube base coincides with the red wire on the support column directly under it.
2. Insert the flashtube and settle it into place, making sure the ceramic base is resting directly on the tops of the screw lugs.
3. Ensure that the tube is vertical.
4. Tighten the three screws on the screw lugs to secure the flashtube.

White Lens Section:

Removal

1. Loosen the two screws securing the upper flashtube assembly and lift the plate up and out of the way to allow access to the bottom flashtube.
2. Pull out the flashtube in the white lens bottom section. You may have to rock it back and forth slightly to remove the tube.

Replacement

1. Align the pins on the flashtube base with their sockets. Notice that the spacing of the flashtube pins must match that of its sockets.
2. Insert the flashtube and settle it into place, making sure the ceramic base is resting directly on the tops of the pin sockets.
3. Ensure that the tube is vertical.
4. Close the top red lens section and secure the latches.

Trigger Transformer, T101

Refer to Figure 4-2 FH 324 Flashhead Component Location.

Removal

1. At the trigger wire post adjacent to the flashtube, remove the large diameter wire coming from the trigger transformer.
2. At one of the smaller, side-mounted ceramic posts, remove the small wire to the trigger transformer. Do not disconnect the primary winding wires (seven turns of hook-up wire).
3. Remove the two 4-40 x 2" Phillips®-head screws holding the transformer assembly to the bracket. Note the orientation of the

molded secondary winding with respect to fixed features on the bracket, since it must be reinstalled with this same orientation.

4. Remove the outer half of the core and lift off the molded secondary winding. The primary winding will remain hanging in place.
5. Remove the inner half of the core.

Replacement

1. Reassemble the primary and secondary windings over the two halves of the core. Attach the core to the bracket using the two long screws.
2. Reattach the wires. Verify that wiring is in accordance with Figure 2-8 FH 324 Flashhead Internal Wiring.

Coupling Transformer, T102

Refer to the flashhead component locations diagram Figure 4-2 and internal wiring diagram Figure 2-8.

Removal and replacement are similar to the procedure for the trigger transformer (T101).

Operational Checkout

Single-Unit System

During testing expose the photocell to normal outdoor daylight. Carefully perform the following steps and take the suggested action if any of the responses differ from the response described.

Triple-Unit System

A system with three power converter units is a triple-unit system. Refer to Section 2 that shows triple-unit installation. You connect the top unit; designated the master unit, terminals TB1-1 and TB1-2 directly to the photocell. The two other power converters each jumper together their terminals TB1-1 and TB1-2.

Each power converter sends a synchronization signal over the , master/slave, bidirectional wires at terminals TB1-4 and TB1-5 to flash all lights together. The top power converter places a signal on the master/slave wires to force the system to flash in white mode(white night backup) if the top red lamp fails to flash. A lamp going out in a tier of red incandescent marker lights indicates a marker alarm but does not cause back-up white-night operation.

Each power converter may control and monitor a tier of steady burning marker lights. In some installations there may be a power converter that does not have associated marker lights.

Marker Light Programming

The 2-4740-XX timing board(PCB1) has jumpers/switches labelled MKR0 and MKR1 which are cut/opened for programming the number of markers installed on a tier.

The 2-4747-XX timing has software programming for selecting the monitoring of marker lights. The XX in the 2-4747-XX part number label shows the software program number. The program is set at the factory.

Testing Each Unit

To test each unit in a triple-unit system, use the following procedures:

1. Disconnect the wires labeled master/slave interconnect at TB1-4 and TB1-5.
2. Test this unit as described in Section Single-Unit System.

Photocell Testing

The photocell is wired directly to the first (master) power converter at TB1-1 and TB1-2.

1. First, disconnect the photocell. The single-unit, or triple-unit, system should revert to nighttime operation in about 45 seconds.
2. Disconnect TB1-4 and TB1-5 on each power converter.
3. Operate the intensity control switch on each power converter in turn.
4. If each power converter operates correctly with the intensity control switch, troubleshoot the photocell wiring or the circuits in the incorrectly operating power converter.
5. Reconnect all wires.

Checkout Procedures

Use Table 3-3 to checkout the equipment. Open the cover of the power converter or converters to perform the procedures. To check out multiple units, all units must be operating. Observe and confirm the operation for each power converter individually. The procedures assume the photocell is exposed to daytime sky conditions. Set all intensity select switches to AUTO, which allows the photocell to control the intensity.

The steps in Table 3-2 or Table 3-3 are related to each other and should be performed together in the sequence given here. If a unit does not behave exactly as described, proceed to Troubleshooting the System in this section.

Table 3-2 Checkout of Power Converters with PCB1 24740xx Board

Setup to Check Normal Daytime Operation	Response — LEDs and Structure Lights
Photocell in daylight. 1) Intensity Select Switch in AUTO. 2) Apply power (pull out interlock switch plunger).	· HV Warning Light is ON · NITE ERR LED (I 1) is off. · DAY ERR LED (I 7) is off. · PEC ALM (I 2) is off. · WHT ALM LED (I 8) is off. · RED ALM LED (I 3) is off. · MKR ALM LED (I 9) is off. · FAN LED (I 4) not used. · SYNC LED (I 10) flashes on in a regular pattern. May be difficult to see. · CONF LED (I 5) "flashes" on after each strobe flash. May be difficult to see. · DAY LED (I 11) is on. On during daylight. · NITE LED (I 6) is off. Off during daylight. · MKRS LED (I 12) is off during daylight. · NEON bulb (I 13) is on; trigger voltage is available; this bulb may blink. · White strobe is flashing at daylight high intensity. · Red markers are off.
Setup to Check Normal Nighttime Operation	Response — LEDs and Structure Lights
Place opaque cover over photocell (block all light). 1) Intensity Select Switch in AUTO. 2) Apply power (pull out interlock switch plunger).	· HV Warning Light is ON · NITE ERR LED (I 1) is off. · DAY ERR LED (I 7) is off. · PEC ALM (I 2) is off. · WHT ALM LED (I 8) is off. · RED ALM LED (I 3) is off. · MKR ALM LED (I 9) is off. · FAN LED (I 4) not used. · SYNC LED (I 10) flashes on in a regular pattern. May be difficult to see. · CONF LED (I 5) "flashes" on after each strobe flash. May be difficult to see. · DAY LED (I 11) is off. Off at night. · NITE LED (I 6) is on. On at night. · MKRS LED (I 12) is on at night if markers are associated with the power converter being observed. · NEON bulb (I 13) is on; trigger voltage is available; this bulb may blink. · Red strobe is flashing at night intensity. · Associated red markers are on.
Setup to Check Default Night Operation	Response — LEDs and Structure Lights
Perform this procedure for each power converter individually in a multi-unit system. 1) Place opaque cover over photocell (block all light). 2) Intensity Select Switch in AUTO. 3) Remove power. 4) Disconnect purple wire on TB2-6. This fails the red flashing light. 5) Reapply power.	Responses after three flash cycles: · HV Warning Light is ON · NITE ERR LED (I 1) is off. · DAY ERR LED (I 7) is off. · PEC ALM (I 2) is off. · WHT ALM LED (I 8) is on. · RED ALM LED (I 3) is on. · MKR ALM LED (I 9) is off. Goes on initially intensity. but then goes off when structure enters white night back-up mode. · FAN LED (I 4) not used. · SYNC LED (I 10) flashes on in a regular pattern. May be difficult to see. · CONF LED (I 5) "flashes" on after each strobe flash. May be difficult to see. · DAY LED (I 11) is off. Off at night. · NITE LED (I 6) is on. On at night. · MKRS LED (I 12) is off at night during white back-up operation. · NEON bulb (I 13) is on; trigger voltage is available; this bulb may blink. · White strobe is flashing at white back-up intensity. · Associated red markers are off. *Remove power.* *Restore all wires to their previous positions before disconnecting any new wires.* *Reconnect the purple wire on TB2-6.* *Reapply power.*

Table 3-2 Checkout of Power Converters with PCB1 24740xx Board (Continued)

Setup to Check Marker Alarm	Response — LEDs and Structure Lights
1) Place opaque cover over photocell (block all light). 2) Intensity Select Switch in AUTO. 3) Remove power. 4) Remove fuse F4.(removes power to marker lights). 5) Apply power.	Responses are the same as those for normal nighttime (previous) except for the following: · MKR ALM LED (I 9) is on. · MKRS LED (I 12) is on. · Red light is flashing at night intensity. · Red markers are off. *Remove opaque cover over photocell. Remove power.* *Replace fuse F4.* *Reapply power.*
Setup to Check White Alarm for Day Operation	**Response — LEDs and Structure Lights**
1) Remove opaque cover over photocell. 2) Intensity Select Switch in AUTO. 3) Remove power. 4) Disconnect black wire from TB2-4. 5) Reapply power.	Responses are the same as those for daylight (previous) except for the following: · DAY ERR LED (I 7) is on. · WHT ALM LED (I 8) is on. Turns on in three flash cycles after applying power. · CONF LED (I 5) is off. · White strobe is off. *Remove power.* *Replace wire on TB2-4.* *Reapply power.*
Setup to Check Red Alarm for Night Operation	**Response — LEDs and Structure Lights**
1) Place opaque cover over photocell (block all light). 2) Intensity Select Switch in AUTO. 3) Remove power. 4) Disconnect purple wire from TB2-6. 5) Apply power.	Responses are the same as those for normal nighttime (previous) except for the following: · NITE LED (I 6) is on. · WHT ALM LED (I 8) is off. · RED ALM LED (I 3) is on. Turns on in three flash cycles after applying power. · CONF LED (I 5) is off. *If you leave the system on, it will next attempt to flash in white night backup (default).* *Remove power.* *Replace wire on TB2-4.* *Reapply power.*

Table 3-3 Checkout of Power Converters with PCB1 24747xx Board

Setup: Check Normal Daytime Operation	Response — LEDs and Structure Lights
1) Apply power (pull out the interlock switch plungers to the service position). 2) Set the intensity select switch or switches to AUTO. 3) Verify that the responses occur at each power converter in the system.	Verify that the following responses occur at each power converter in the system: · The HV Warning Light is on. · The NITE ERR LED (I 15) is off. · The DAY ERR (I 9) is off. · The PEC ALM (I 14) is off. · The WHT ALM LED (I 8) is off. · The RED ALM LED (I 13) is off. · The MKR ALM LED (I 7) is off. · The FAN LED (I 12) is off. · The SYNC LED (I 6) "flicks" on regularly. May be difficult to see in bright daylight. · The CONF (confirm) LED (I 11) "flashes" on after each strobe flash. May be difficult to see in bright daylight. · The DAY LED (I 5) is on. It is on during daylight. · The NITE LED (I 10) is off for daylight operation. · The MKRS (markers) LED (I 4) is off during daylight operation. · The clear NEON bulb (I 3) is on indicating the presence of trigger voltage for the flash tube. This bulb may blink. · The white light is flashing at the daytime high-intensity for this unit. · The associated red incandescent markers are off.
Setup: Check Normal Nighttime Operation	Response — LEDs and Structure Lights
1) Place an opaque (blocks all light) cover over the photocell. Several seconds may pass before the photocell responds to the darkened condition after power is applied. 2) Set the intensity select switch or switches to AUTO. 3) Apply power (pull out the interlock switch plungers to the service position).	Verify that the responses occur as in Daytime (previous) except for those in the following list: · The DAY LED (I 5) is off. · The NITE LED (I 10) is on for night operation. · The MKRS (markers) LED (I 4) is on if markers are associated with the power converter being observed. · The red light is flashing at the nighttime intensity for this unit. · The associated red incandescent markers are on.
Setup: Check Normal Default Night Operation	Response — LEDs and Structure Lights
Perform the following procedure for its power converter in a multiple-unit system. 1) Cover the photocell with an opaque (blocks all light) cover. 2) Set the intensity select switch or switches to AUTO. 3) Remove power. 4) Disconnect the purple wire on TB2-6. This fails the red flashhead. 5) Reapply power.	Verify that the following responses occur as compared to those in Check Normal Daytime Operation, except for those in the following list (after three flash cycles): · The WHT ALM LED (I 8) is on. · The RED ALM LED (I 13) is on. · The DAY LED (I 5) is off. · The NITE LED (I 10) is on for night operation. · The MKRS (markers) LED (I 4) is off. It is off during white night backup mode. · The system is flashing in white night back-up intensity. *Remove power.* *Reconnect the purple wire on TB2-6.* *Restore all wires to their previous connections before disconnecting any new wires.* *Reapply power.*

Table 3-3 Checkout of Power Converters with PCB1 24747xx Board (Continued)

Setup: Check Marker Alarm Operation	Response — LEDs and Structure Lights
1) Cover the photocell with an opaque (blocks all light) cover. 2) Set the intensity select switch or switches to AUTO. 3) Remove power. 4) Remove fuse F4. 5) Reapply power.	Verify that the following responses occur as compared to those in Check Normal Daytime Operation, except for those in the following list (after three flash cycles): · The DAY LED (I 5) is off. · The NITE MODE LED (I 10) is on. · The MKRS (I 4) LED is on indicating that markers should be on. · The MKR ALM (I 7) LED is on indicating a marker alarm. · The top flashhead (red) is flashing. · Remove power. · Replace F4 and recycle the unit with the Intensity Select Switch as done in Setup · Reapply power. · The unit should now be operating normally in night mode; that is: red light flashing, markers turned on, and no alarm. *Remove the temporary opaque cover placed over the photocell in Step 2.* *Set Intensity Select Switch to AUTO.* *Replace Fuse F4.*
Setup: Check White Alarm for Daytime Operation	Response — LEDs and Structure Lights
1) Remove the opaque cover from the photocell. 2) Set the intensity select switch or switches to AUTO. 3) Remove power. 4) Disconnect the black wire from TB2-4. This fails the white flashhead. 5) Reapply power.	The following responses indicate a failure to flash in day mode. Verify that they occur as compared to those in Check Normal Daytime Operation, except for those in the following list (after three flash cycles): · The WHT ALM LED (I 8) is on. (The power converter executes 3 flash cycles internally after power application. The White Alarm turns on at the end of the three cycles.) · The DAY ERR LED (I 7) is on. · The SYNC LED (I 6) flicks on regularly. · The CONF (flash confirm) LED (I 11) is off. *Remove power.* *Reconnect the black wire to TB2-4.* *Reapply power.* *Verify operation as in Daytime Operation.*
Setup: Check Red Alarm for Night Operation	Response — LEDs and Structure Lights
1) Place the opaque cover over the photocell. 2) Set the intensity select switch or switches to AUTO. 3) Remove power. 4) Disconnect the purple wire from TB2-6. 5) Reapply power.	The following responses denote a light failure during normal nighttime operation. Verify that they occur as compared to those in Check Normal Daytime Operation, except for those in the following list (after three flash cycles): · The DAY MODE LED (I 5) is off. · The NITE MODE LED (I 10) is on. · The RED ALM LED (I 13) is on. (The power converter cycles executes 3 internal flash cycles before turning on the Red Alarm.) · The SYNC LED (I 6) flicks on regularly. · The CONF (flash confirm) LED (I 11) is off. These denote a light failure during normal nighttime operation. *NOTE: If you leave the system on, it will next attempt to flash in white night backup mode(default).* *Remove power.* *Reconnect the purple wire to TB2-6.* *Reapply power.* *Remove cover from photocell.* *Verify operation as in Daytime Operation.* *Reapply power.*

Troubleshooting the System

Effective troubleshooting begins with careful observations of operating behavior, often leading directly to the cause of a problem. Diagnostic procedures in this subsection are divided into two categories: unit level, originating in a single unit; and system level, problems affecting all units in a triple-unit system in the same way. However, in a triple-unit system some unit-level malfunctions could cause problems involving the entire system.

For example, if one light in a triple-unit system fails to flash, Table 3-4 directs you to Table 3-5, the troubleshooting guide for a unit-level problem (but not a system-level problem).

For each symptom, the troubleshooting guides list one or more probable causes in descending order of probability. Continuing with our example, assume that the light fails to flash during the day (No in column 1) and at night (No in column 2). High voltage is absent (No in column 3), but low voltage is present (OK in column 4). This condition is described in the fourth row of Table 3-5.

The last column lists possible causes. The most probable cause is a shorted capacitor, the second most probable cause is a shorted flashhead cable, and so on.

When you trace a problem to a specific component, see Subsection Power Converter Component Testing and Subsection Component Removal and Replacement, in this Section.

Table 3-4 Selecting the Correct Troubleshooting Guide

	Single-Light System	Triple-Unit System	
		Units Affected Differently, Usually Only One Failing Unit (Unit-Level Problem)	All Units Affected the Same Way (System Level Problem)
Troubleshooting Guide	*Table 3-5*	*Table 3-5*	*Table 3-6*

Table 3-5 Unit Troubleshooting Guide

Flash Conditions		Other Conditions			Probable Causes (All Units Unless Specifically Indicated)
Day	Night	HV†	LV*		
No	No	OK†	OK		· Flashhead cable connections · T3 Transformer · BR1 Bridge · T1 Transformer · PCB1
No	No	No	No	Blows Fuse F1	· Varistor MOV · T1 Transformer
No	No	No	No		· F1 Fuse · T1 Transformer · S1 Interlock · Connections - main power
No	No	No	OK		· C2A-D, or C3 shorted · Shorted FH Cable
No	No	OK	No	No indicators lit on PCB1	· PCB1 Board · BR1 Bridge · T1 Power Transformer
OK	High Intensity	OK	OK	Red Alarm	· PCB1 Board · K2 Relay · Photocell Circuit · Intensity select switch setting
OK	OK	OK	OK	All Markers Out	· F4 Fuse · K5 Marker Control Relay‡ · PCB1 Board
				Markers Stay On	· K5 Marker Control Relay‡ · PCB1 Board
OK	Backup Intensity	OK	OK		· K2 Relay · PCB1 Board
OK	OK	OK	OK	Marker Alarm	· One or more marker lamps out or incorrect wattage · K5 Marker Control Relay‡ · PCB1 Board · PCB3
-	-	OK	OK	Incorrect Mode	· S2 Intensity Select Switch is not in AUTO position · PCB1
OK	No	OK	OK	Red Alarm	· Flashtube (top red flashhead) · PCB1 · K2 Relay · C3 Capacitor Open · L1 Burst Choke · K5 Relay · R2 Burst Resistor
OK	Backup Intensity	OK	OK	Red Alarm	· F5
Red	OK	OK	OK		· PCB1 Board
Red or White	OK	OK	OK	White Alarm	· PCB1 Board
No	OK	OK	OK	White Alarm	· Flashtube (bottom flashhead) · PCB1 Board · K2 Relay · L2 Flash Choke · C2A-D Capacitors Open · K5 Relay

† HV = High voltage. PCB2 or HV neon lamp lit confirms HV.
‡ Replace the entire red light module if any components therein fail.
* LV = Low voltage. Any PCB1 LEDs on confirms LV.

Table 3-6 System Troubleshooting Guide

Flash Conditions		Other Conditions	Probable Causes
Day	Night		
OK	Day Flash	Possible photocell Error	· Photocell · PCB1 Board · Intensity Select Switch · Jumper on TB1 & 2 on slave units missing
Red	OK	Possible photocell Error	· Photocell · Intensity Select Switch
-	-	Units mixed red and white	· Photocell cable connected to TB1-1 and -3 (all units will be in night mode) · Intensity Select Switch
OK	OK	Units not flashing together	· Master/slave interconnect cable connected to TB1-4 and TB1-5. · PCB1 in one unit.
No	No	No lights	· Main power line

Using the Intensity Select Switches — Finding the Failing Unit at Night

For normal operation, set the intensity select switches on each unit to AUTO. In AUTO, an intensity signal through the master/slave interconnect wires on TB1-4 and TB1-5 controls the day or night intensity level of all power converters and associated lights. Any power converter may send the sync signal on these wires, which flashes all lights at the same time. Normally, all units on a structure have backup enabled. Should a flashhead fail in AUTO night operation, the power converter with the failing flashhead sends a back-up signal to the other units on the interconnect wires. If the failing flashhead is the top-most and is correctly connected to the master, all strobes will go into white back-up mode.

You can switch any unit to day or night operation (manual operation) with its intensity select switch. In manual operation, the following conditions occur on the switched power converter:

In Night Mode:

- It does not send a back-up signal.
- It operates the red light only.
- It clears its red alarm (if it has one) and then re-establishes the alarm.
- It does not affect the other units.

In Day Mode:

- It ignores the master/slave interconnect line (sync and back-up signals).
- It operates the white light only.

When a top red light alarm occurs at night, the back-up signal from the failing master power converter switches all units to night intensity white operation. With the preceding information, you can determine master unit in the system is causing the entire system to run in white night intensity.

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Section 4 — Recommended Spare and Replaceable Parts

Power Converter Parts

Table 4-1 lists the major replaceable parts.

Flashhead Parts

Table 4-2 lists the major replaceable parts.

Photocell Parts

The part number for the PEC 510 Photocell is PN #1855001.

Repackaging

Equipment must be returned in a container that provides maximum protection during shipping and handling. If the original cartons and packaging material are no longer available, package the power converter and flashhead separately as in the following subsections.

Power Converter

Package and ship the power converter in an upright position; that is, with the feet downward. Pad the power converter so that the feet cannot penetrate the box during shipment. Box each power converter separately using a double thickness cardboard container and adequate padding. Do not drop. Use appropriate warning labels on the outside of the container.

Flashhead

Package and ship the flashhead in an upright position. Box each flashhead separately and use adequate padding. Attach the flashhead base to a plate measuring 19 inches square (e.g., 3/8 inch plywood). Use a double thickness cardboard (or wood) container which is 19 inches square by about 32 inches high (inside dimensions). Use soft packing or a cardboard collar around the lens to prevent tipping inside the container. Do not drop. Use appropriate warning labels on the outside of the container.

Table 4-1 Power Converter Major Replaceable Parts

Item	Description	Part Number
BR1	Diode Bridge	6902806
C2A, C, D	Capacitor, 70 mfd.	6720401
C2B	Capacitor, 40 mfd.	6386503
C3	Capacitor, 1 mfd.	6848202
C4	Capacitor, 3 mfd.	6577903
F1, F2	Fuse, Power, MDL8	*† 4901931
F4	Fuse, Marker, MDL5	4900345
F5, F6	Fuse, MDL1	4900337
HV	Neon, High Voltage Light	4902317
K2	24V Relay, Mode	† 8900494
K3	120V Relay, Discharge	† 8900493
L1	Choke, Burst	4850601
L2	Choke, Flash	4175200
LS1	Phone Line Surge Protector	2865301
M1	Red Light Module	† 1811502
MOV	Varistor	6901079
PCB1	Timing and Trigger Board — PC 324 (non-“E” models)	*† 2474019
PCB1	Timing and Trigger Board — PC 324E — Two Markers	*† 2474719
PCB1	Timing and Trigger Board — PC 324E — Three Markers	*† 2474749
PCB2	HV Rectifier Board	*† 2458005
PCB4	Sense Module	2811101
PCB5	Alarm Board — “AE” models	2805404
R1	Resistor, Discharge, 35K 50W	6900541
R2A & B	Resistor, Burst (two 500-ohm resistors of the indicated part number comprise one burst resistor)	6900532
S1	Switch, Interlock	4901220
S2	Switch, Toggle	† 8799201
T1	Transformer, Power, 60 Hz	8841201
T1	Transformer, Power, 50 Hz	8842901
T3	Transformer, Coupling	8336701
TB1	Terminal Strip, 18 position	4901930
TB2, TB7	Terminal Strip, 6 position	4902257
TB3	Terminal Strip, 11 position	8721011
TB4, TB5	Terminal Strip, 3 position	4902134
TB5	Terminal Strip, 6 position	4902257
TB6, TB8	Terminal Strip, 3 position	4902157
VR1	Varistor, 130V	8250801
VR1	Varistor, 250V	8250802

* This part number varies according to the specific equipment configuration and function. Be prepared to describe the system configuration when you call Customer Service for the correct PCB1 Timing and Trigger Board or fuse part number for your particular system. Have available the part number of your current PCB1 when you call.

† Recommended as a spare part.

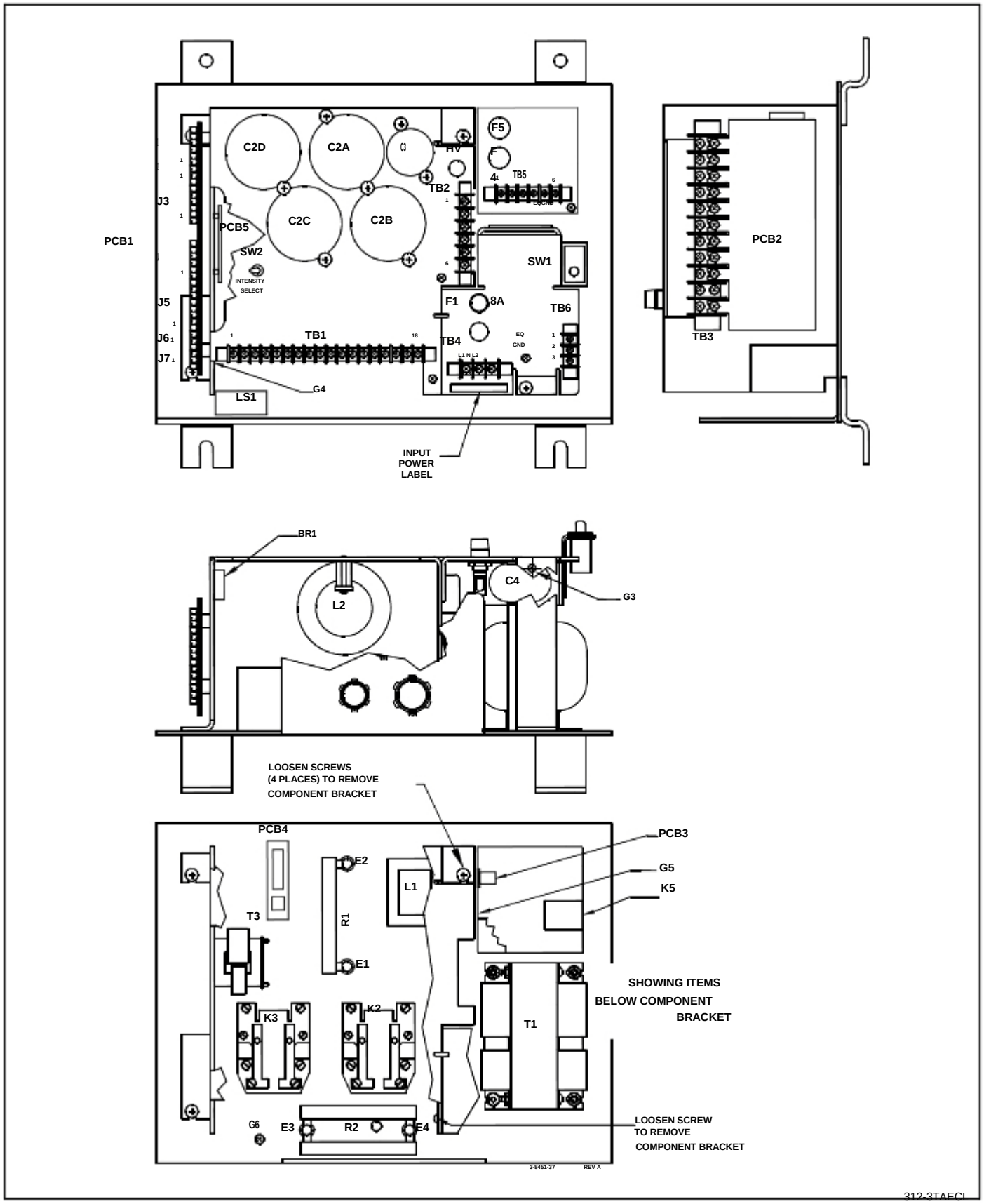


Figure 4-1 PC 324 Power Converter Component Location

Table 4-2 Flashhead Major Replaceable Parts

Item	Description	Part Number
FT101	Flashtube, Upper Flashhead	8384308
FT101	Flashtube, Lower Flashhead	8384308
P1, P2, P4, P5, P12	Ceramic spacer, 3/4" diameter	5900844
P3, P11	Ceramic spacer, 1/2" diameter, short	5900842
P6, P7, P8	Ceramic spacer, 1/2" diameter, tall	5900843
RC101	Resistor-capacitor network	1403411
RC102	Resistor-capacitor network	1403412
T101	Transformer, Trigger	8288201
T102	Transformer, Coupling	8336701

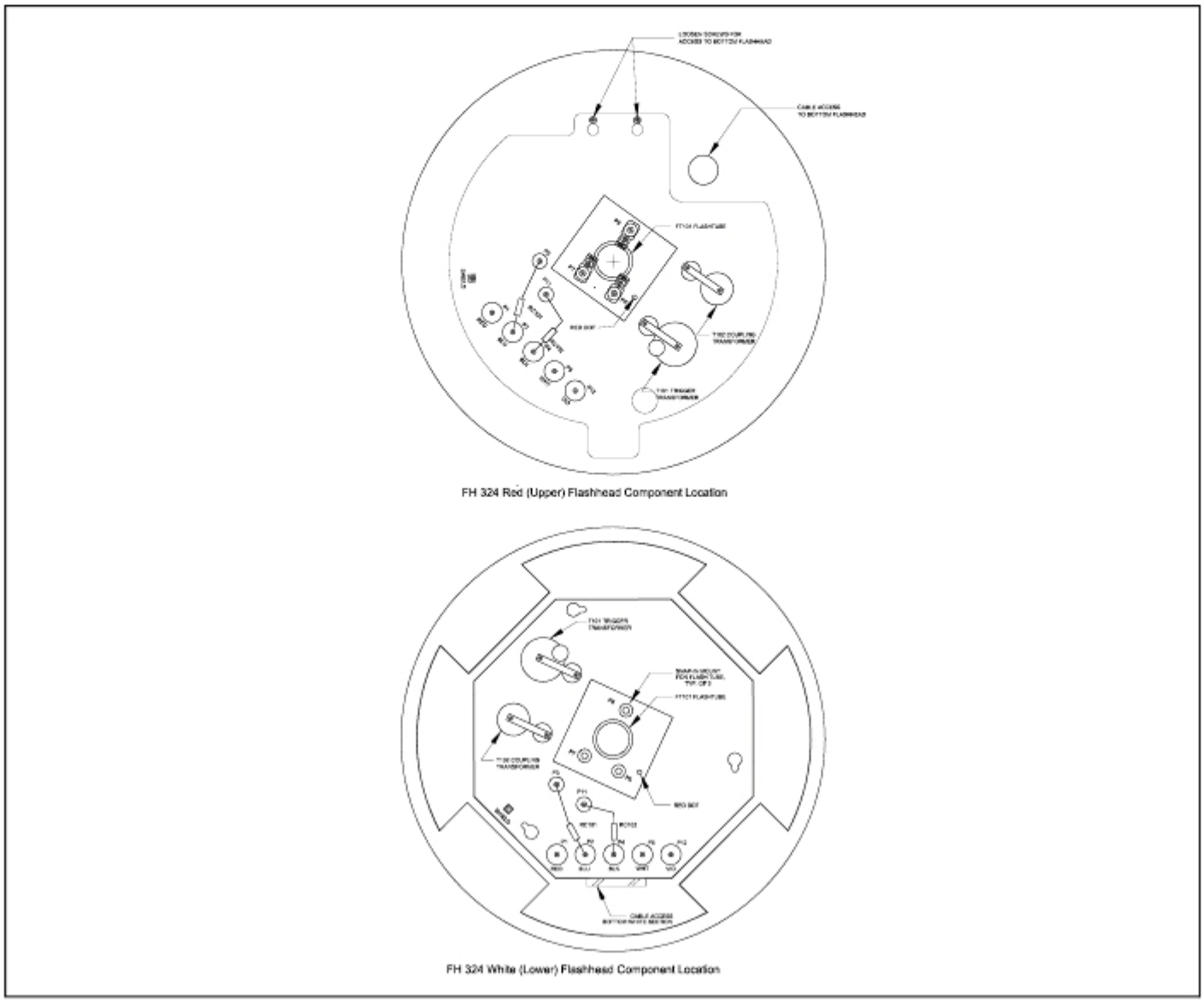
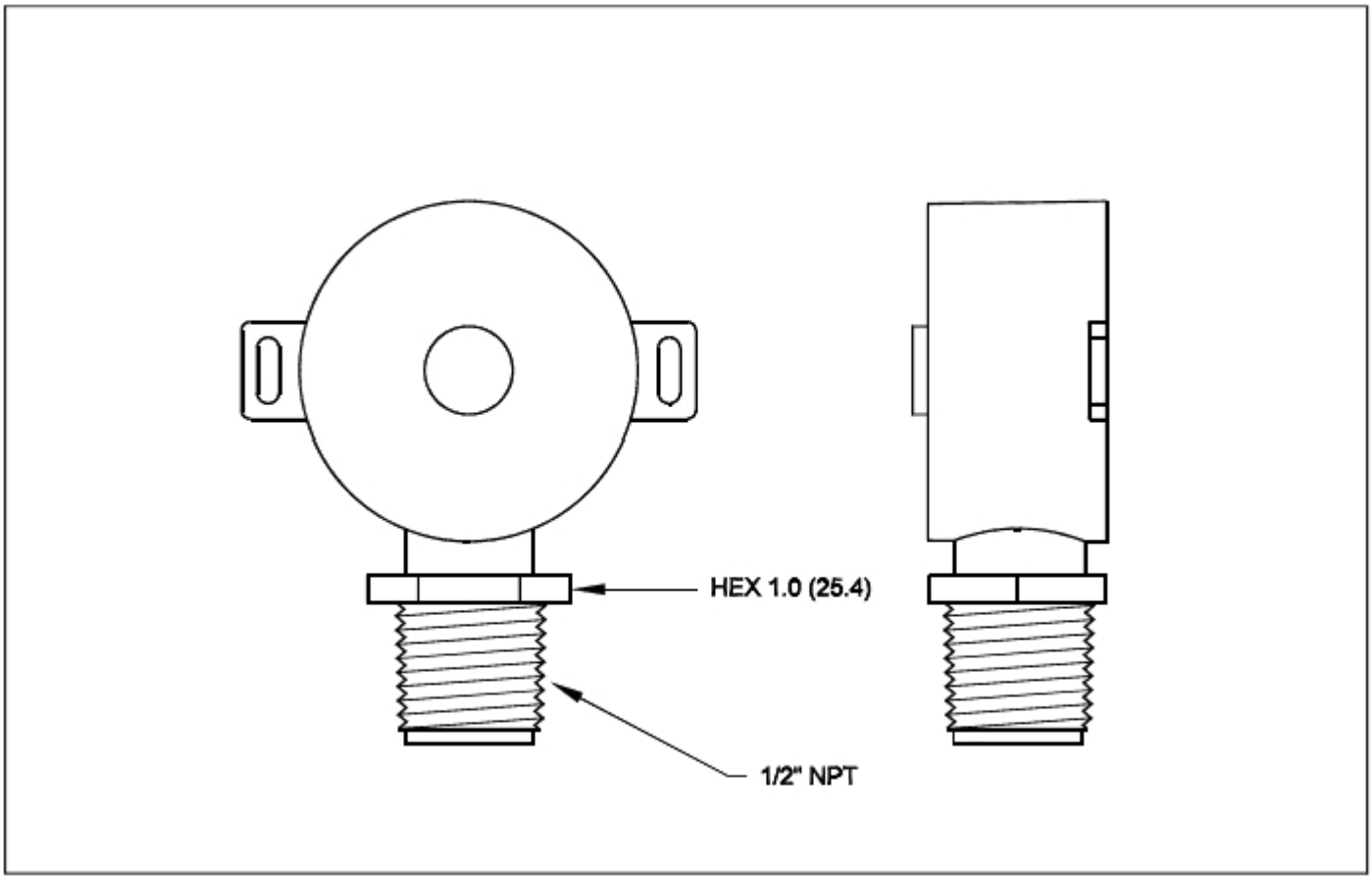


Figure 4-2 FH 324 Flashhead Component Location



PEC510CL

Figure 4-3 PEC 510 Photocell

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